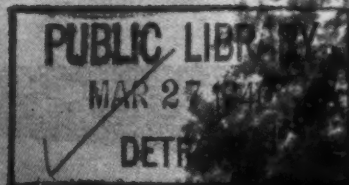
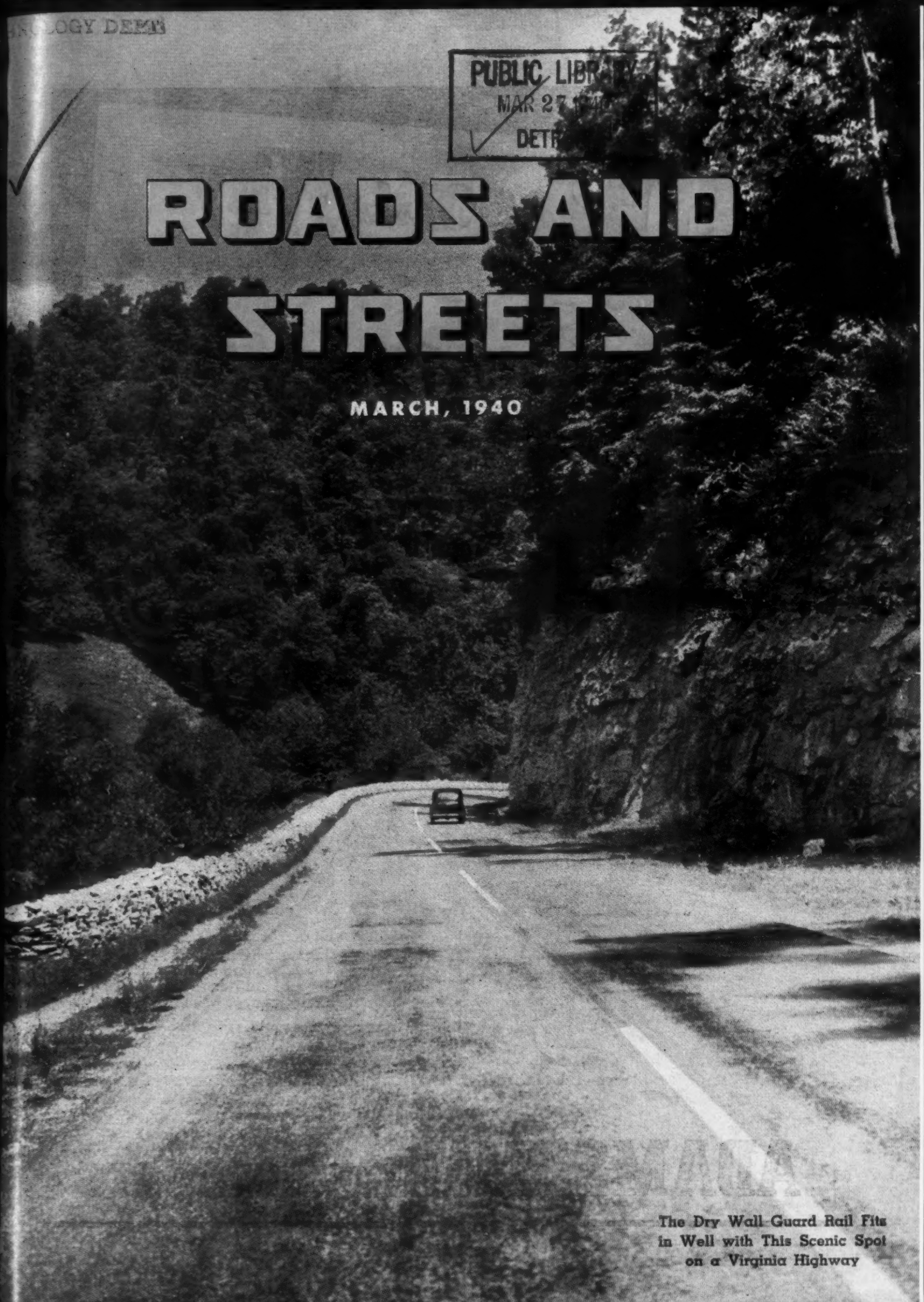


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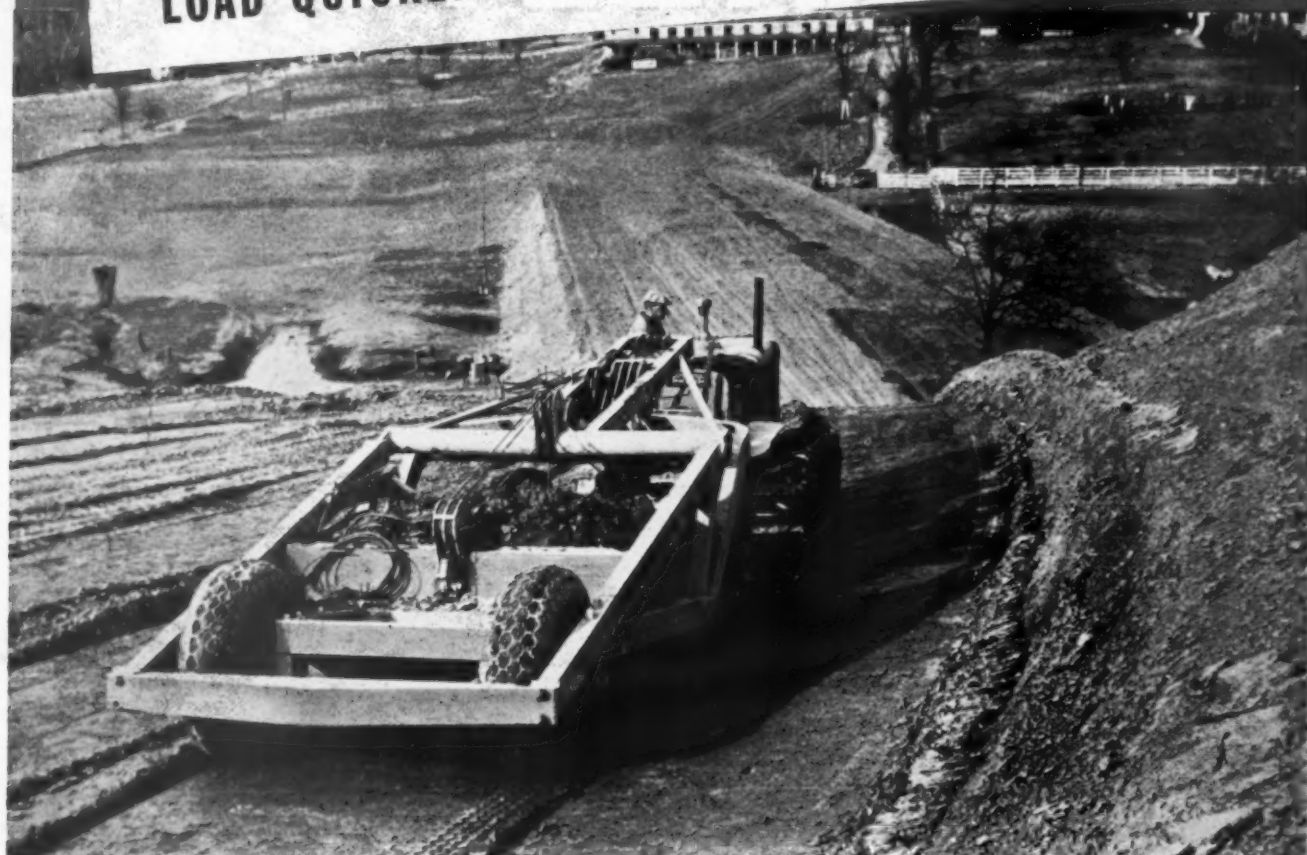
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MARCH, 1940



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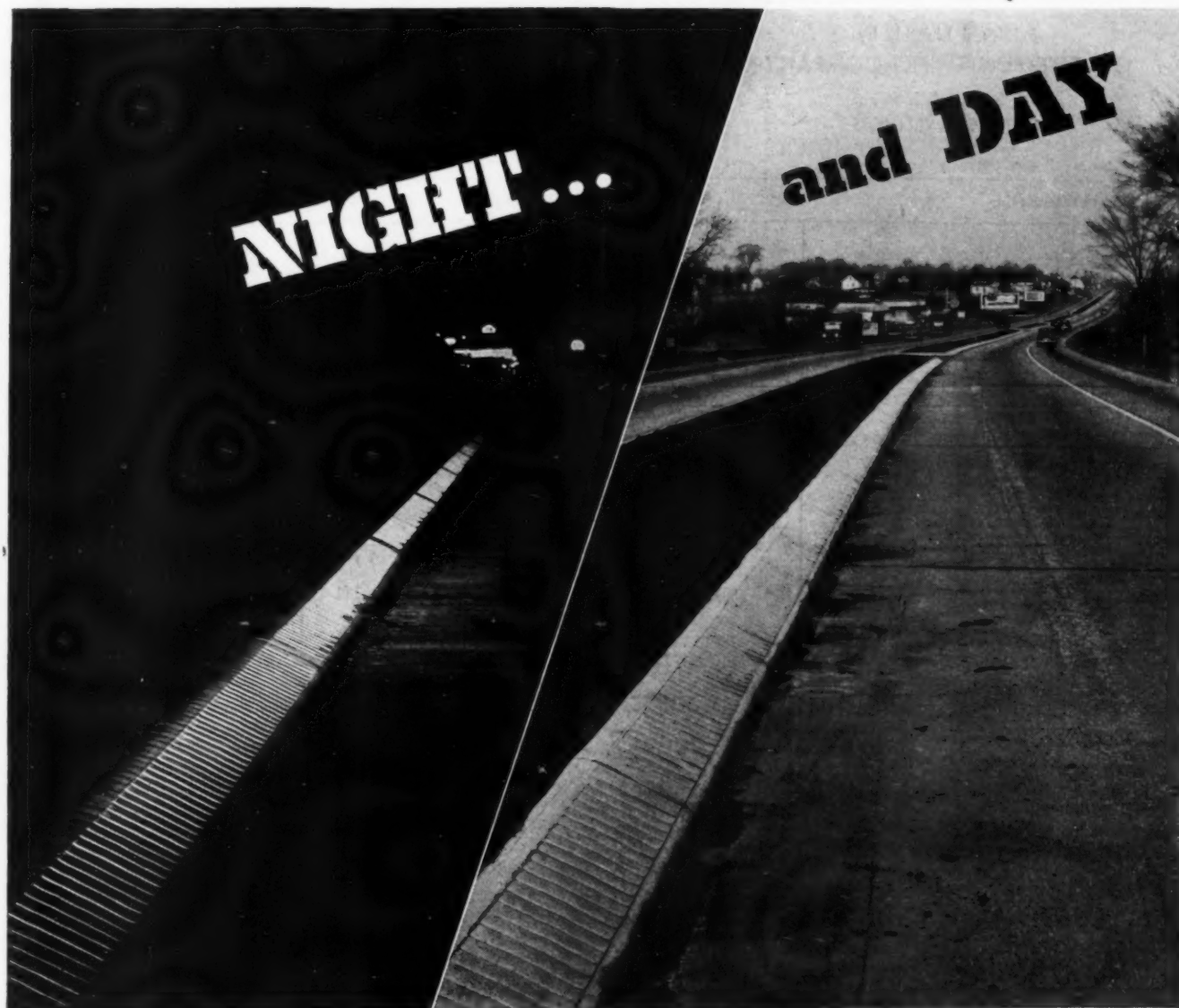
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330 South Wells Street  
CHICAGO, ILLINOIS



THIS MAGAZINE IS DEVOTED TO  
Design, Construction and Maintenance  
of Highways, Streets, Bridges and Grade  
Separations

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Copyright 1940, by Gillette Publishing  
Company. Acceptance under the Act  
of June 5, 1934, authorized January 25,  
1938, at Chicago, Illinois. Subscription  
price \$3.00 per year in the United States,  
\$4.00 per year for foreign mailing.

Vol. 83

MARCH, 1940

No. 3

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# ROADS and STREETS

Vol. 83, No. 3

March, 1940

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## DANGEROUS CURVES BEHIND

*North Carolina Rebuilds an Obsolete Section of Important Primary State Highway, Involving Heavy Grading Work*

By JAMES S. BURCH

*Engineer of Statistics and Planning*

*N. C. State Highway & Public Works Commission*

**I**N STEP with the current trend toward modernizing main highways, and eliminating dangerous sections, the North Carolina State Highway and Public Works Commission is rebuilding an 8-mile length of unsuitable highway on one of the main interstate and intrastate routes. The highway in question carries Route U. S. 29, the most important North-South industrial route through the state, connecting Atlanta and Washington; Route U. S. 70, the main East-West route from the seacoast

to the mountains, and U. S. 52, a state highway of some local importance. This project involves heavy grading, and is being laid out for future conversion to a 4-lane superhighway with dividing center park strip.

The existing highway was completed in 1923, at a time when the cost of heavy excavation was quite expensive, as compared with current costs. For this reason, the existing road was built on alignment unsuitable to modern traffic, in order to avoid excessive grading costs.



*One of the 5 Grading Outfits Being Used on the Project. This Outfit Near North End of Project Was Idle for Lunch Period When Picture Was Taken*



*Sharp, Dangerous Curve on Existing Road, at Approach to Yadkin River Bridge. This Dangerous Condition Is Being Eliminated on New Project*

At the time the existing road was built, earth excavation cost from 35 ct. to 50 ct. per cubic yard, and rock excavation cost from \$1.50 to \$2.50 per cubic yard. The present cost of unclassified excavation on this contract is only 19½ ct. This reduction in cost through the years has been brought about primarily through improved equipment and methods; and the contractor on this job was enabled to make his current bid only because of the availability of highly efficient modern earth work equipment.

### The Existing Road

To avoid excessive costs on the original construction, the alignment of the existing highway was built very



*Rock Cliff North of Yadkin River Bridge Being Cut Through on New Project*

crooked, as compared to modern standards. It includes numerous blind spots, and is altogether unsuitable for the modern, heavy, high speed traffic, amounting to almost 3,000 vehicles per day as an annual average, including a large percentage of heavy truck traffic. It is estimated since 1923 this existing road has been used by vehicles over 13,000,000 times, and to this extent the drivers of these vehicles have had to negotiate the 29 curves on the existing road, of which 8 curves were excessively sharp; as well as 38 limited sight distances and several steep grades.

### New Project

The section of road under discussion is from the Yadkin River Bridge, which is located north of Spencer and Salisbury; to the City of Lexington, N. C., a distance of 8.3 miles along the new project. While the new grading job generally parallels the existing highway, and the main line of the Southern Railway, the new project is being built on a completely new location with modern alignment, light curves, long sight distances, and minimum grades. At the very beginning of the project, the existing highway leaves the Yadkin River Bridge and turns sharply to avoid a rock cliff about 40 ft. high, and the alignment for the first mile or two of the existing road is very crooked. The new grading job leaves the bridge on a tangent, and goes straight through the rock cliff. The heaviest grading work on the project is on



*18 Yd. Scraper Excavating and Using Pusher; the Pusher Also Handling the Other 18 Yd. Pan*

the end nearest this bridge, and in the rock cliff cut mentioned above, which is about 1200 ft. long, and in which, there is about 78,000 cu. yd. of excavation, including about 53,000 cu. yd. of rock. The alignment through this cut includes a very gentle curve of 1½ degrees, the grade climbing from the river bridge through the cut at a 4 per cent rate. The remaining section of this 8.3-mile job involves rather heavy excavation for this rolling country, the whole project requiring the removal of 597,000 cu. yd. of unclassified excavation, and 19,500 cu. yd. of borrow excavation, at 19½ ct. per cu. yd.

The project also includes a new concrete bridge, and several concrete culverts, involving some 1,800 cu. yd. of Class "A" structural concrete at \$18.00 per cu. yd., and some 320,000 lb. of reinforcing steel at 4 ct. per lb. complete in place.

The cross section of the project for 2-lane operation is 47 ft. wide in cuts and 42 ft. wide in fills, the slopes being quite flat on the light fills, and steeper on the deep fills. The state's landscape engineer has maintained a representative on the project throughout the clearing work, in order to save as many attractive trees as possible. A gradual system of transition was used on all



*Crawler Wagon, Dump Truck, and Sheepfoot Roller Making Fill at Station 13*

major cuts, and 10-ft. width shoulders are being built, instead of the usual 5-ft. or 6-ft. width.

Looking to the future, the project is being graded on one side of a proposed 4-lane superhighway with center park strip on a 150-ft. right-of-way. The future plans call for the ultimate construction of two 22-ft. paved sections, divided by a 32-ft. center park strip. Looking toward this future superhighway section, all reinforced concrete culverts on the job were designed and built so that later extensions may be made.

The cost of the current project for the 8.3 miles of grading and structures is \$192,000, or an average of \$23,000 per mile. The roadway grading contract, amounting to \$138,820, was let to contractor W. C. Shepherd of Atlanta in September of 1939, and the structure contract, amounting to \$52,931, was let to D. M. Rickenbaker of Union, S. C., at the same time.



*Shovel Loading Truck at Station 11*

### Improved Alignment

The new road will be shorter by  $\frac{1}{2}$  mile than the old road. The new alignment involves only four gentle curves in eight miles, the sharpest of which is only a  $1\frac{1}{2}$  degree curve. There are only four grades on the new location steeper than 3 per cent, and the steepest of these is 4.1 per cent, near the Yadkin River Bridge. The vertical curves are very long, being up to 1,800 ft. in length on hilltops, with sight distances having been designed for a minimum of about 1,000 ft.

### Economic Considerations

Due solely to the fact that the travel distance to the vehicle owner is being shortened by  $\frac{1}{2}$  mile, it is conservatively estimated that the annual savings to vehicle users in gasoline, oil and tires will approximate \$15,000; this not taking into account the important factors of time saving and elimination of hazard, which factors may be of equal magnitude. It is further indicated that these direct savings to vehicle operators alone will be sufficient to completely pay for the new grading, structures, and the 2-lane pavement, in less than 25 years.

Based on previous gross income from gasoline tax earnings on this section, the original investment in the existing pavement has already been retired as of 1939, according to reasonably approximate calculations.

Furthermore, based on a conservative rate of increase in future traffic, and at current gas tax levels, it is estimated that the entire cost of the new grading, structures, and the 2-lane pavement will be retired in about 11 years on the basis of gross direct earnings to the highway fund.

### Progress and Job Operations

As of January, 1940, the grading contract was about 80 per cent complete, and the structure contract was about 70 per cent complete. It is anticipated that the entire project will be completed during April or May of 1940. Plans propose the paving of this section at an early date.

In order to handle the excavation work at the low price of  $19\frac{1}{2}$  ct. per cu. yd. for earth work, including about 13 per cent rock, it was necessary that the contractor, W. C. Shepherd, use modern equipment and



methods throughout. As an indication of the high type of equipment used, it may be noted that more than 75 per cent of the wire rope and cable used on this job equipment was preformed wire rope. Several contractors on this project have found preformed wire rope capable of reducing shutdown time for repairs and cutting rope replacement costs. It resists the fatigue of small diameter drums and sheaves on scrapers and carryalls and so lasts longer on all equipment.

That the equipment used gave excellent performance is indicated by the fact that, during two fall months of 1939, a total of 418,000 cu. yd. of excavation was moved.

The contractor's average force was 140 men; and the grading outfits, during the two months of operation mentioned above, used:

23,000 gal. of gas; 27,000 gal. of fuel oil, and  
2,400 gal. of motor oil.

A consolidated list of grading equipment includes:

Three 18-yd. Pans,  
Five Pans of smaller size,  
Seven Blades and Road Machines,  
Three 16-yd. Crawler Wagons,  
Three 11-yd. Crawler Wagons,  
Two Elevating Graders,  
Nineteen Tractors, Bulldozers, etc.,  
Five Sheepsfoot Rollers,  
One 10-ton 3-wheel Roller,  
One Rooter Plow,  
Four 8-yd. Trucks,  
Three 4-yd. Trucks,  
Sixteen 2-yd. Trucks,  
Four Compressors,  
Sixteen 2yd. Trucks,  
Four Compressors,  
A Wagon Drill,  
A Drilling Machine,  
Six Jack Hammers.

The structure contractor used one ½-yd. crane, and four mixers and an air compressor.

**Engineering.**—The project is being built at the direction of Mr. L. E. Whitfield, Division Engineer, and T. J. McKim, Assistant Division Engineer, under the direct supervision of W. S. Hollinsworth, Resident Engineer.

### COST OF ASPHALT PLANT MIX, LOS ANGELES, CALIF

The city of Los Angeles, Calif., has had a municipal asphalt plant for many years. Some interesting figures on the operation of the older plant compared with the present plant were given by Mosher Meyer, Superintendent of Streets, in a paper presented at the 12th National Asphalt Conference.

In 1919 in the Bureau of Engineering, City of Los Angeles, Calif., the cost of hauling plant mix on a ton-mile basis was 12 ct. as compared to 3.52 ct. in 1939. The salaries of truck drivers in 1919 were less than today. The lower cost may be attributed to the improvement in equipment and to hauling larger loads on trucks with a lighter tare rate, and to the elimination of delay, both at the plant and on the job, made possible by improvements.

The cost of laying one ton of material by the old hand method in 1919 was 76 ct. per ton for labor and equipment. Approximately 150 tons a day was the average daily capacity of a crew. The cost of laying one ton of

material with an asphalt paver and spreader in 1939 was 37 ct. per ton for labor and equipment, 700 tons being the average daily capacity. The hand-laying gang in 1919 consisted of

6 laborers;  
2 asphalt workers;  
2 roller operators;  
1 asphalt construction foreman.

The equipment was

1 3-wheel roller;  
1 tandem roller;

and the necessary small tools.

The labor necessary to operate a machine spreading and laying gang today is

4 laborers;  
3 asphalt workers;  
1 asphalt finishing machine operator;  
2 form setters;  
1 truck driver;  
3 roller operators;  
1 asphalt construction foreman.

The equipment is

2 tandem rollers;  
1 3-wheel roller;  
1 truck;  
1 asphalt finishing machine;  
1 set of asphalt spreaders;  
1 spray tank for applying tack coat.

The plant operated in 1919 turned out approximately 350 tons a day at an average plant cost of 67 ct. a ton. The most modern plant of the city today has turned out approximately 800 tons a day at an average plant cost of 24 ct. per ton.

In 1919 the city of Los Angeles was laying approximately 300 tons of asphaltic mixtures a day, using a 40-50 penetration asphalt. It was thought at this time that these low penetration asphalts were necessary to get stability. Some work was being done experimentally in treating mineral aggregates with a range of binders from a 70 per cent asphaltic road oil to a 90-95 asphaltic road oil. Great strides have been made in this direction in the past 20 years. Plant mixed surfacing similar to asphalt concrete may be prepared by using a 90-95 asphaltic road oil as a cementing medium. This mixture is necessarily spread while still warm. From the experimental stages mentioned before, the city of Los Angeles has developed the use of this plant mix to the extent that in the year 1937, 25,000,000 sq. ft. of roadways were resurfaced with an average thickness of 1½ in., using this type of material.

### OPERATING COST—RURAL MAIL CARRIER AUTOMOBILES

In recently issued Bulletin 143 of the Iowa Engineering Experiment Station, Professors R. A. Moyer and Robley Winfrey analyze cost records of 293 automobiles operated by rural mail carriers. Some of the specific results are summarized below:

	On Pavement	On Gravel	On Earth
Av. cost gas, oil, tires and maintenance, per mile.....	1.56 ct.	2.59 ct.	3.14 ct.
Av. gasoline mileage, per gal.....	15.02	13.04	13.52
Av. oil mileage per quart.....	264	152	113
Av. gasoline cost, winter, per mile..	1.50 ct.	1.54 ct.	1.58 ct.
Av. gasoline cost, summer, per mile	1.21 ct.	1.24 ct.	1.13 ct.
Av. maintenance cost, winter, per mile .....	0.28 ct.	0.77 ct.	1.70 ct.
Av. maintenance cost, summer, per mile .....	0.05 ct.	0.38 ct.	0.63 ct.

# SNOW DRIFT CONTROL

## *By Highway Design*

### *Result of Wind Tunnel Investigations Interpreted*

**I**MPORTANT contributions to the knowledge of highway construction in its relation to snow drift control have been made by the Engineering Experiment Station of the Michigan State College of Agriculture and Applied Science through a laboratory wind tunnel study of air-flow across models of various types of highway cross sections.

The results of the study are reported by E. A. Finney, assistant research engineer, Michigan State Highway Department, in a 60-page bulletin, "Snow Drift Control by Highway Design." The bulletin also includes a summary of the different highway design methods of snow drift control used by a number of states in the snow belt, together with a general outline of the causes of drifting and the corrective measures to be applied. It is noted that "on our secondary and township road systems there exists a rich field for practicing snow drift control by preventive methods."

In the laboratory wind tunnel study model cross sections built to a scale of 1 in. equals 2 ft. were inserted into the tunnel's air stream, with a mixture of flake mica and balsa sawdust used to simulate snow and reveal the direction of air motion.

The purpose of the tests was to determine the relationships between the height and shape of embankments and the characteristic eddy area and the drifting these cause. The investigation included a study of: height of embankment and length and shape of eddy area; the effect of embankment slope; and the effect of curving top and bottom of embankment slopes and fill sections.

Findings from the wind tunnel tests are reported as follows:

#### **Relationship Between Height of Embankment and Length of Eddy Area**

The length of the eddy area produced by a vertical em-

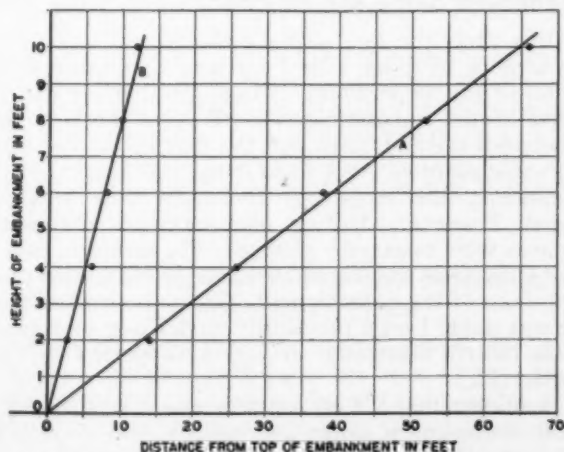
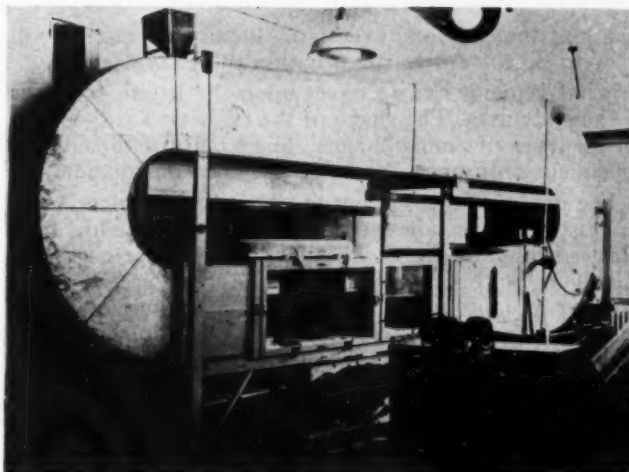


Fig. 1.—Relationship Between Height of Embankment and Length of Eddy Area. Curve A = End of Eddy Area. Curve B = Position of Maximum Depth of Drift



Wind Tunnel Used in the Investigation

bankment was found to vary directly with the height of the embankment. The length of the eddy is approximately  $6\frac{1}{2}$  times the height of embankment. In other words, an embankment 6 ft. in height will produce an eddy area 39 ft. long measured from the top of the slope of the embankment. The results of tests made on models representing embankments of different heights are given in Table I and illustrated by curves in Fig. 1.

The eddy area is composed of three major parts. They are illustrated in Fig. 2 and designated as A, B, and C. At part A the air is in circular motion about a horizontal axis parallel to the face of the embankment. The motion of the air in part A is counter clockwise. In part C the air also rotates about a horizontal axis parallel to the embankment but the motion is clockwise. The clockwise motion of the air in part C carries the windborne snow towards the face of the embankment and deposits it in the area marked B. The size and location of B is governed by the quantity of drifting snow and the velocity of the wind. The greater the velocity of the air, the greater will be the sweeping action of part C and consequently the maximum drifting will occur at part B. The position of B will be close to the surface of the embankment. Under average wind velocities and in heavy snow areas, drifting will take place throughout the entire

TABLE I—RELATIONSHIP BETWEEN HEIGHT OF EMBANKMENT AND END OF EDDY AREA

Height of Embankment in Feet	—Distance in Feet to—	
	Maximum Depth	End of Eddy Area
2	3	14
4	6	26
6	8	38
8	10	52
10	12	66

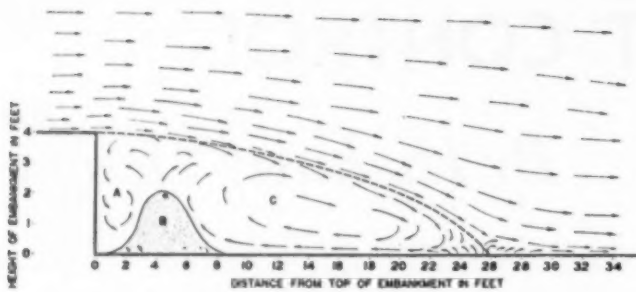


Fig. 2.—Characteristics of the Eddy Area Formed by an Embankment

length of the eddy and eventually the drift in part B will grow to fill the entire space within the eddy area.

Wind velocity has no effect upon the length or shape of the eddy area. The shape of the eddy area is the same for all types of embankments. The length of the eddy is dependent only upon the height of the embankment.

The grade of the windward slope of the embankment will effect to a certain extent the length of the eddy area. This is shown in Fig. 3. Previous tests conducted by the Michigan State College Experiment Station (2) show that for a slope of 1 ft. vertical to 2 ft. horizontal the increase in length of the eddy area is 19 ft. in the case of a 4 ft. embankment. The results of other slopes are illustrated by the curve in Fig. 4.

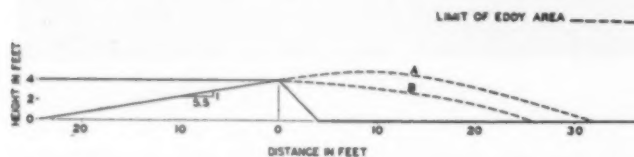


Fig. 3.—Relationship Between the Windward Slope of Embankment and Length of Eddy Area

The fundamental shape of the eddy area formed by an embankment is ichthyoid in character. This fact is clearly illustrated in Fig. 2. An area of confusion exists at the end of the eddy area where the air streams return to the surface of the ground. This area extends for several feet on each side of the critical point. The motion of the air in this area is turbulent with definition motions towards and away from the embankment. It was found that the eddy areas formed by all types of barriers or embankments are very similar to shape and character. This fact has been brought out by other experiments on snow fences and tree plantings. The coordinates for this type of curve are given in Table II.

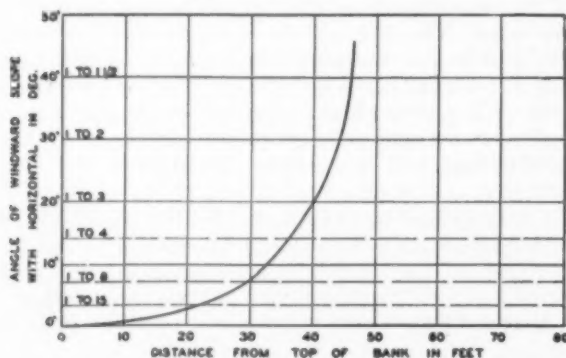


Fig. 4.—Relationship Between Length of Eddy Area and the Grade of the Slope on the Windward Side of the Embankment Face

TABLE II—COORDINATES FOR EDDY AREA BOUNDARY CURVE

$h$ = Height of Embankment	
Distance in Feet from Top of Embankment	Height in Feet from Ground to Top of Eddy Area*
0.00 $h$	1.00 $h$
0.65 $h$	0.975 $h$
1.30 $h$	0.950 $h$
1.95 $h$	0.875 $h$
2.60 $h$	0.825 $h$
3.25 $h$	0.750 $h$
3.90 $h$	0.650 $h$
4.55 $h$	0.575 $h$
5.20 $h$	0.425 $h$
5.85 $h$	0.275 $h$
6.50 $h$	0.000 $h$

\* Note: These values are true only when the ground on the windward side of the embankment is approximately level.

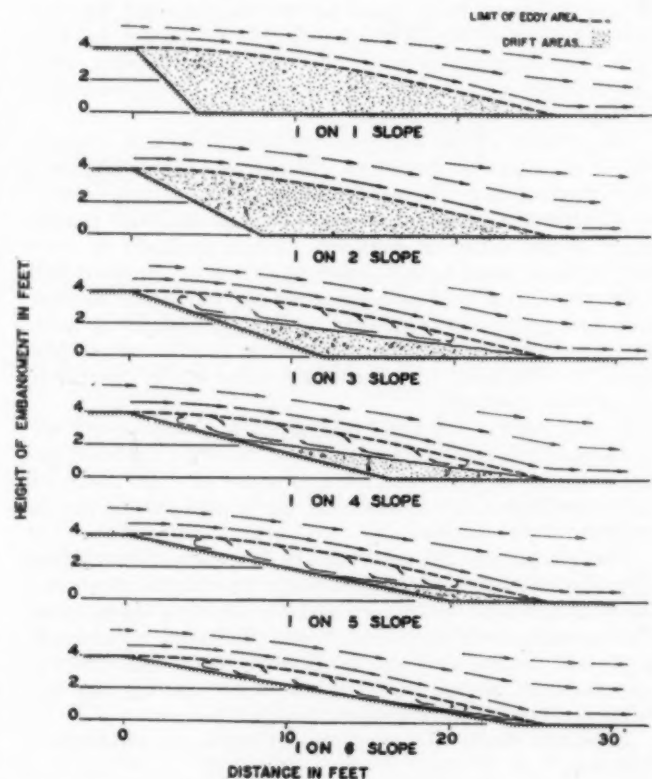


Fig. 5.—Illustrating Effect of Embankment Slope on Amount of Drifting

### Embankment Slope and Its Effect Upon Eddy Area

In this study the face of the embankment was varied from a slope of 1 on 1 to 1 on 6 to determine if the position of the slope would change the drifting characteristics of the embankment. In all cases the boundary line between the eddy area and the moving air remained in the same position. Also, measuring from the top of the embankment, the length of the eddy area was not changed. However, drifting characteristics within the eddy area were materially changed. For instance, part A of the eddy area was eliminated and drifting took place on the face of the embankment. When the embankment slope was made 1 on 4 practically no drifting took place. This is clearly illustrated in Fig. 5 supported by data in Table III.

It is evident that a 1 on 6 grade would be the best to use for embankment slopes because a 1 on 6 slope practically coincides with the boundary curve of the eddy area, thus eliminating any possibility of drifting from wind-borne snow.



TABLE III—RELATIONSHIP BETWEEN SLOPE OF EMBANKMENT AND DRIFTING CHARACTERISTICS

Height of Embankment	Face Slope	Beginning of Drift	End of Slope	End of Drift	End of Effective Area
4 ft.	Vertical	0 ft.	0 ft.	0 ft.	26 ft.
4 ft.	1 on 1	0 ft.	4 ft.	9 ft.	26 ft.
4 ft.	2 on 1	0 ft.	8 ft.	26 ft.	26 ft.
4 ft.	3 on 1	4 ft.	12 ft.	26 ft.	26 ft.
4 ft.	4 on 1	6 ft.	16 ft.	Slight drift	26 ft.
4 ft.	5 on 1	12 ft.	20 ft.	Very slight drift	26 ft.
4 ft.	6 on 1	16 ft.	24 ft.	No drift	26 ft.

### The Effect of Rounding Top of Backslope

Results indicate that the drift producing characteristics of an embankment are not changed by rounding the top edge of the embankment slope. The length and shape of the eddy area remains practically the same as for the unrounded edge. About the only thing gained by rounding the top of slopes is to improve the appearance of the embankment. However, the drifting of the snow takes place farther down the face of the slope. Apparently the rounded slope allows some of the air stream to deflect slightly downward causing the drift to form nearer to the toe of the slope. Tests show that as the slope is flat-

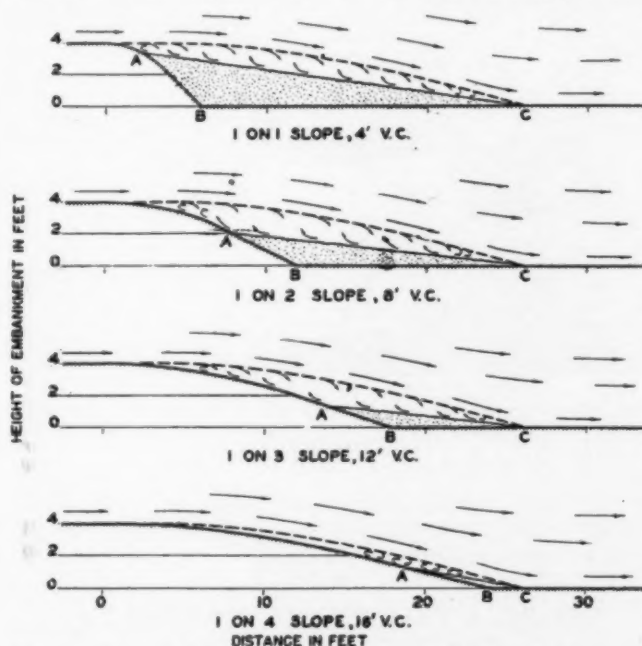


Fig. 6.—Illustrating Effect of Rounding Embankment Slope on Amount of Drifting

tened and the length of the curve becomes longer, the beginning of the drift tends to approach the toe of the slope. It can be plainly seen that the ideal shape of the cross section or face of the slope would be in a form of a curve similar to the shape of the eddy area curve. Results of the study are illustrated in Fig. 6 supported by data in Table IV.

### Effect of Rounding Top and Bottom of Embankment Slope

Results of tests show that rounding both the top and bottom of the slope will have but little effect upon the character of the drifting produced by the embankment. The drift forms in a manner similar to that when only the top of the slope is rounded. In the cases of a 1 on 6 slope drifting is practically eliminated when the top and bottom of the slope is rounded.

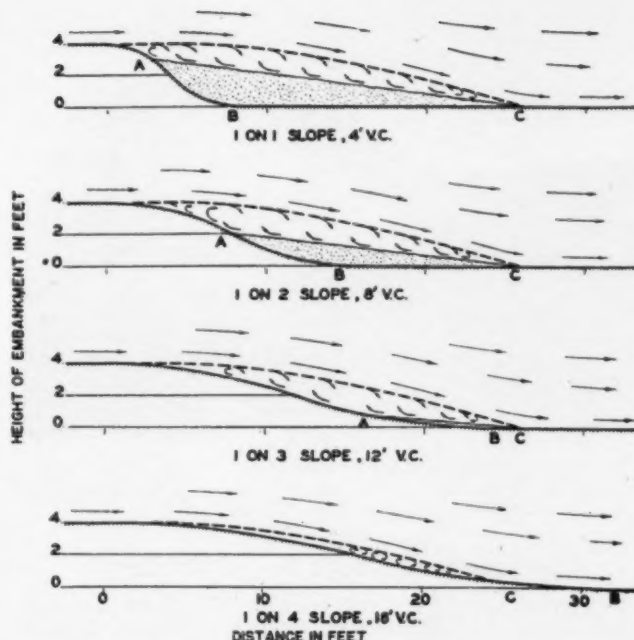


Fig. 7.—Illustrating Effect on Drifting by Rounding Both Top and Bottom of Embankment Slope

This is clearly illustrated in Fig. 7 and supported by data in Table V.

TABLE IV—DATA SHOWING THE EFFECT PRODUCED BY ROUNDING TOP EMBANKMENT SLOPE. HEIGHT OF EMBANKMENT 4 FT.

Slope	Length of Vertical Curve in ft.	Distances in Ft. to Points A, B, C, Illustrated in Fig. 6		
		A	B	C
1 on 1.....	4	2	6	26
1 on 2.....	8	8	12	26
1 on 3.....	12	14	18	26
1 on 4.....	16	19	24	26

TABLE V—DATA SHOWING THE EFFECT OF ROUNDING TOP AND BOTTOM OF SLOPES

Slope	Length in Ft. of Vertical Curves		Distances in Ft. to Points A, B, C Illustrated in Fig. 7		
	Top	Bottom	A	B	C
1 on 1.....	4	4	3	8	26
1 on 2.....	8	8	8	16	26
1 on 3.....	12	12	16	24	26
1 on 4.....	16	16	....	32	26

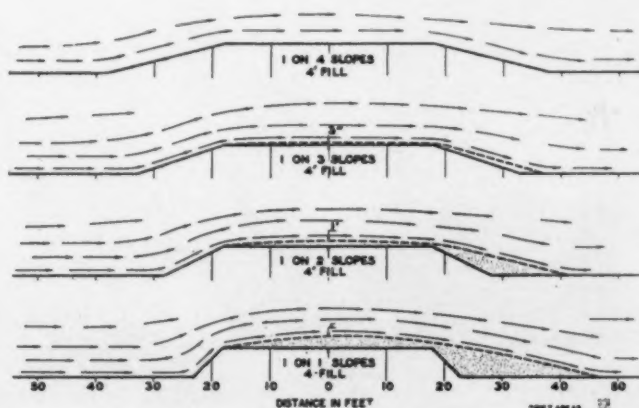


Fig. 8.—Illustrating Air-Flow Across a Fill Embankment with Different Slopes



*This Snogo, Mounted on an International Truck, Is Throwing Windrowed Snow Across Road in Level Terrain After Push Plow Had Opened One Lane. Taken in Iowa*

### Embankment Slopes on Fill Sections

Tests on model fill sections with variable slope gradients indicate that flat slopes are desirable for free air-flow across the section. For slopes steeper than 1 on 4 the character of the slope is such that it will deflect the air stream upward at the shoulder line thus creating a slight eddy over the pavement slab which, under certain conditions might cause drifting. For slopes flatter than 1 on 4, the air stream follows the contour of the cross section leaving no eddy area for snow to accumulate in.

Fig. 8 contains typical cross sections and their effect upon air-flow across the highway.

The results of the wind tunnel tests are also used in the bulletin to diagram and illustrate mathematically how to provide both shallow and deep cut sections for snow storage.

It is pointed out that when snow drift control features are to be employed in the design of fill sections, two important factors must be considered: First, the embankment should be constructed higher than the prevailing snow depth, and second, the embankment slopes should be constructed as flat as conditions will permit. From the standpoint of free air-flow, a slope of 1 on 4 should be considered a minimum value to use, but a slope of 1 on 6 would be ideal.

The chapter of the bulletin devoted to highway design practiced by different states in their snow control programs includes typical cross sections used by Colorado, Indiana, Massachusetts, Michigan, Minnesota, New Hampshire, North Dakota, and Wyoming.



*Even with Streamlining Cut and Fill Slopes, Certain Stretches of Road Will Require Rotary Plow Work Similar to this Snogo Mounted on an International Truck*

Of 24 snow belt states replying to a questionnaire, 12 take into consideration drift control by design methods very extensively, seven practice it in a limited way, two have no standard procedure, and two do not consider snow control in highway design.

The survey of practices by the various states shows that special design features for snow drift control consist essentially of the following: Raising the grade line to a definite position above the adjacent ground line; avoiding cut sections; special treatment of cut sections; the adoption of wide shoulders, flat backslopes, and shallow ditches; the use of vertical curves at the top and bottom of slopes, elimination of guard rail where possible, and the relocation of existing routes.

### Must Still Move Snow

This is obviously a method of design to apply in long range highway planning. Roads already built are going to require snow removal programs until such time as all slope sections are streamlined. In certain localities this method can be applied with little added expense. How-



*Had This Iowa Road Been Streamlined This Caterpillar Motor Grader with V-type Plow Would Not Have Had So Much Snow to Handle*

ever, in other locations the cost of complete snow drift control by proper highway design methods would be so great as to be prohibitive.

### GEORGIA ESTABLISHES DIVISION OF TRAFFIC AND SAFETY

The state highway department of Georgia has organized a new Division of Traffic and Safety with M. C. Bishop as director. The functions of the new division will be to assist and advise officials of the highway department with respect to safety features in construction and maintenance of highways, coordinating the work of the division with that of the State Department of Public Safety, the analysis of and the filing of accident reports, the promotion of safety on the highways and the general regulation of highway traffic.

Other features of the work will have to do with road signs, signals and markings, special studies of hazardous locations, zoned speed restrictions, safety activities of highway department employees and contacts with county and municipal authorities.

The technical side of the program will be in charge of George T. Papageorge, formerly resident engineer in the Macon division of the highway department, who is now completing a special course in traffic safety engineering at Yale University. Mr. Papageorge will begin his duties in June.

# THE STORY OF ROAD ROLLING IN GREAT BRITAIN

By MAJOR T. SALKIELD, M.INST.C.E.

THE rolling of our roads by mechanical means is such an everyday occurrence that it is difficult for the younger generation to imagine a period when no attempt whatever was made, in many places, to prepare, by means of rolling, newly made road surfaces for vehicular traffic. Yet as late as the first decade of this century it was quite the common practice, outside the boundaries of the larger towns and cities, to repair all roads in sections, and by means of obstructions to compel vehicles to roll in the broken stone (macadam). Of course at that time the rubber-tired vehicle was hardly known, but cyclists were vehement in their attacks upon those road authorities who persisted in the old methods of construction.

The first reference to the rolling in of the loose materials, used in the construction of roads, occurs in the year 1619, but the idea does not seem to have been put into practical use until 1787, when a horse-roller was used in France. In the year 1619 John Shotbolte described an invention in his patent as relating in part to the making and repairing of "highway and roads, etc., by the employment of mechanical means," but no description is given nor any details of the manner in which the appliances were to be used. In the year 1699 Nathaniel Bard took out a patent for an invention which is described as "an instrument or engine which will amend and level the roads . . . of the kingdom." But again no detailed description is given of the machine.

In the year 1736, Robert Phillips read before the Royal Society a paper, called by him a "little Treatise," on the condition of the highways of England, especially of those near London. He strongly opposed the system of making road vehicles roll in the broken stone for the consolidation of the finished surface of the carriage-way. This little treatise, or "dissertation" as it is also called, was published in book form, and is divided into three sections. The author remarks:

"Several projects have been proposed and some of these put in practice, such as Rolling, Plowing or Harrowing the Roads and making them flat in the middle but high and low lengthwise with short declivities."

This last method he severely condemns, and notes that a man and horse soon become tired going up and down a series of small hills.

This ridiculous method of corrugated road-making, which made rolling impossible, seems to have been in use for some years after Phillips produced his "dissertation." In the *Gentleman's Magazine* for May, 1749, we read that: "Some roads in England . . . are laid wavy or rising and falling, and men attend . . . after rain to let out the water with their spades." The same magazine, in the March, 1756, number is illuminating on this subject, and notes that:

"In respect to the form of laying roads whether waved or otherwise this is simply the case: were there not ruts, nor any narrow wheeled carriages to make

them, to lay the roads in waves would be unnecessary; a proper descent on each side the road would be quite sufficient. But while there are ruts it is absolutely necessary that the water should lie in them as little as possible."

Another reference (1759), to this same subject of corrugated road surfaces reads:

"In level countries where the roads are cut, these waves are absolutely necessary. . . . The first waving of the roads was begun in Whitechapel on the Essex Road. The waves were then short and high and soon were found so excessively inconvenient to the travelers both on foot and horseback and in carriages that they were discarded."

With such evidence as this, it is not surprising that any idea for the consolidation of road surfaces by rollers, other than the wheels of vehicles, made no progress.

In the year 1753 Parliament began to consider how far it was possible to convert heavy wagons from machines of destruction into instruments of utility for road-rolling and preservation. With this object in view privileges were introduced, such as employing more horses and the payment of reduced tolls according to the breadth of tire. This extraordinary method of compelling the traffic to make its own roads reached a climax when vehicles with roller wheels 16 in. broad were exempted from turnpike tolls whilst the owners of vehicles with tires less than 6 in. in width were mulcted in double tolls.

A writer in the year 1764 (a year before the Broad Wheel Act expired) argued that broad wheels were unnecessary, and that 6-in. wheels would be sufficient if the fore-axle could be made 1 ft. shorter than the hind one, so that the track of the wheels together would be 12 in. He further mentioned the fact that the diminution of toll on broad-wheeled vehicles had so impoverished the turnpike trustees that no money was available for the purchase of materials to be rolled in by such vehicles. Thus do we see how legislation may easily defeat its own ends.

An advertisement dated 1773 for "Rolling Carts and Waggon's" is very informative upon the state of the highways of that period. The picture shows a vehicle like a wain in appearance, but of two-horse length, covered with a tilt upon which the words "James Sharp Leadenhall Street London—Common stage" occur. It is drawn by four pairs of horses, but, instead of wheels, four rollers are employed. The advertisement for this type of vehicle puffs the advantages, refers to practical tests and states that:

"By the use of Rolling Waggon's, the Road, so far from being injured was a very extraordinary sight, the Quarters formed by the Rollers, both in the Private Roads and Turnpikes, were so even and flat as to make an excellent Passage for Horses abreast, or any Kind of Quartering Carriages, and so smooth and



clean that even foot Passengers preferred them to walking in the Fields, and the Road being thus rolled enabled the Cattle to draw much heavier Loads than are usually carried.

"The following Encouragement is allowed by the two late Acts of Parliament to Carriages upon this Construction. By an Act for the Amendment and Preservation of the public Highways all Carriages moving upon Rollers of the Breadth of 16 in., are allowed to be drawn with any number of Horses, or other Cattle. And by an Act for regulating the Turnpike Roads, such Waggons are allowed to carry eight Tons in Summer and Seven Tons in Winter, and may be drawn by any number of Horses or other Cattle.

"They are also permitted to pass upon any Turnpike Road TOLL FREE for the Term of One year to be completed from Michaelmas 1773, and, after the Expiration of the said Term, shall pass upon any Turnpike Road, through any Toll-Gate or Bar for Half-Toll.

"This Encouragement to Rollers, together with the several restraints laid upon Nine Inch as well as narrow wheels by these Acts, make it the Interest of all People to put their heavy Carriages upon Rollers, which cannot fail of making every Road in the Kingdom perfectly smooth."

It was not, however, until the First Report of the Committee appointed by Parliament to deal with the subject of Turnpike Roads and Vehicles was published in the year 1806 that any serious attempt was made to study the question of road-rolling. In the portion of that report which deals with the subject "Breadth of Wheels" it is laid down that "the narrower the rim, the more damage it does to the roads; and if cylindrical, the broader it is, consistently with other circumstances, the more it improves them." From this date, and for a long time afterwards, legislation favored the use of broad wheels by means of total exemptions from or a decrease in turnpike tolls. At that time the idea became general that some means ought to be adopted to make the roads smoother for the swifter and safer passage over them of the lighter types of vehicles. The exemptions from tolls caused an immediate increase in the breadth of the wheels of the heavier vehicles; and ingenious methods were introduced by which the fore and hind wheels ran in different tracks. When the breadth of tire reached 16 in., and so gained total exemption from tolls, the owners of such vehicles soon realized that tractive effort was so much increased that it was not an economic proposition. To overcome this, and at the same time to claim the exemption, the builders of road vehicles caused the tires to be rounded for those of 9 in. width; and for those of greater width, up to 16 in., the middle portion of the tire was thickened. This had the effect of enabling the wheel to run on a width of 2 to 3 in. only, and in this way to defeat the object the legislation had in view—the rolling of the roads—when granting toll decrease or total exemption.

Telford was very critical about broad wheels and the lack of intelligence on the part of the legislature in dealing with this subject, and remarked that their

"remote posterity . . . may still perhaps witness the stately instrument of destruction in the form of broad-wheeled stage waggons laden with eight tons slowly crushing road repair materials dearly purchased and usually far-fetched."

In the year 1816 John Woodhouse took out a patent which reads:

"Methods of forming the ground for roads and

pavements and also of paving or repairing old pavements and roads."

The objects of this invention are accomplished by the employment of a machine

"so constructed as to work one or more stampers of such weight and length of stroke, according to the need of the case, to ram down the surface operated upon to any assignable degree of solidity, so as to give it power to support the greatest weights that can or may be likely to be put upon it without sinking under it."

The stampers were eight in number and covered a width of 9 ft.; each was of 3 cwt. and lifted 3 ft. twelve times a minute. These stampers were placed upon a carriage and worked either by steam or manual power.

In 1817 Philip Hutchinson Clay patented a large roller and his specification for this reads:

"My said invention consists of the following points:

*Firstly* a plow made with two shares, one to fill the right side of the material thrown out of the rut again into it, and the other the material on the left side; and by adding an additional plow, making it a double one, you can plow in a double set of ruts at the rate of 12 to 14 miles per day.

*Secondly* a harrow which is intended to scarify the uneven parts of any road, leaving it even after the operation, previous to the use of the great roller.

*Thirdly* the gravel cart, which is fixed upon the roller to carry gravel or other material used in the repairs of the roads, and deposit it where it is necessary; the great advantage being that it improves the roads it passes over, and will be particularly useful in districts where material is scarce, whereas the present mode of carrying it in carts with narrow wheels destroys the road it passes over.

*Fourthly* the large roller which, with the carriage over it empty or full with gravel or other material, may be made to press upon the road any weight from 6 to 20 tons, and by being used frequently will press the moisture to the surface and admit the sun and air to act upon it, at the same time pressing down the loose material and making the road more even. It should be used immediately after the plow has been at work on any road."

The single contrivance was drawn by three or four horses and the double one by five horses.

The gravel cart was fitted with "9 slides" to allow gravel to be discharged according to the area of the road to be dealt with, and it (the gravel cart) was built hopper shape, fitted with an axle and pulley mechanism for raising the front of the cart to tip the materials towards the openings fitted with "slides."

Another provision in the patent states that:

"If the material is wet or adheres to the sides of the cart a person can rake it down, or a spiked roller can be fixed from side to side with teeth to draw it down to the slides."

The roller under the gravel spreading cart was 2 ft. 6 in. diameter, 6 ft. long, and of cast iron—weight 1 ton.

The "Great Roller" was of the same dimensions, but was weighted by means of a similar hopper-shaped gravel cart. This was drawn after the loaded distributing gravel cart.

In the *Courier* of October 8, 1817, the opening paragraph of a long article, under the caption "Roads", reads:

"We some time since stated that Mr. Clay, who recently obtained a patent for certain machinery, calculated to effect an improved formation of the roads, had contracted for their repair with several Commissioners in this district, and we have now the satisfaction to announce that the first experiment ever made

on a large scale is in progress on the road from Leeds to Wakefield, and that it has been attended with a degree of success truly astonishing.

"The advantages of the system are so immense, and of so much national importance, that we cannot but congratulate the public on the result of this first practical application of Mr. Clay's invention, principally that of operating, in combination with other machines, by a stupendous roller, that can be loaded to almost any weight, and by means of which we have seen on one day a road raised two feet, and on the next, after having been just subjected to the operation of the machines, exhibiting all that solidity and smoothness, hitherto peculiar to the best roads, and in their state of greatest perfection.

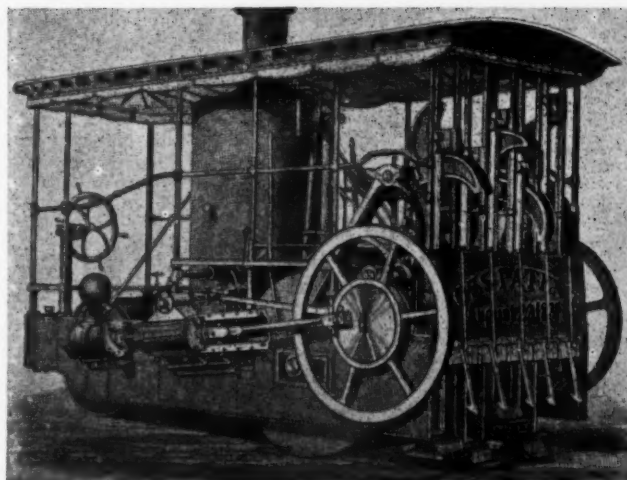
"The thanks of the public are eminently due to the Commissioners of the Leeds and Wakefield road, for having so judiciously perceived the excellency of Mr. Clay's mode, and for having so promptly enabled that Gentleman to put the country in possession of its advantages. The effect seems almost that of magic. The roads are at once rendered smooth, hard and even; and what is most important, by the regular application of the machines, they must always remain so. A narrow-wheeled wagon apparently makes not the slightest impression, but passes over the impenetrable surface of the road as if upon marble. The system eminently conduces to safety, as well as to beauty and durability, for it is impossible that any loose stones or other material can exist upon the surface. All is reduced into one immovable mass by the ponderous roller, which either forces the largest stones into their bed, or crushes them to powder."

After so flattering a description of a machine which could produce such wonderful results, it is a source of surprise to find that in 1825 a man called John Biddle took out a patent for a machine which was something of a box of tricks and reminiscent of a Heath Robinson contraption. It had a large scraper which pushed all the loose stones and mud to the side of the road, and immediately behind it were three large cast-iron rollers, each running on a separate axle and staggered. Over this part of the machine was fixed a large semi-circular iron box container, which could be loaded up with broken stone to increase, as required, the weight of the rollers, and thus to improve their capacity for consolidating the loose materials on the road.

Behind this part of the machine a separate perforated roller, called a "drying roller," could be attached. Immediately in front of this roller two small scrapers were fixed to push aside the surplus stones and mud. The perforations in the roller were intended to pick up the semi-liquid mud, which was then carried on the inside of the roller until it came into contact with a brush, which swept it into a tank suspended on the axle of the roller. This tank was emptied by means of a side door, which was flush with the outside of the open-ended roller. The whole machine was drawn by one, two, or more horses in single file.

The picture (Fig. 1) is that of a contraption made about 70 years ago by an American engineer named Ross. The five beaters of this ramming machine, which weighed 20 tons, were actuated by cams, and gave an effective stroke equal to 3 tons for each ram. The lower part of the engine acted as a water-tank. Many inventors from an early date were engaged upon the solution of the problem of how best to secure a smooth and sound road surface, and the Ross machine is a link between the historic past and the present.

The later history of road-rolling is, of course, asso-



By the courtesy of Messrs. E. Arnold & Co., Publishers. From "Modern Roads"—H. Percy Boulnois.

Fig. 1—The Ross Ramming Machine

ciated with the steam-driven roller, which has been described as a "Rotund Robust Robot." In the year 1859 the first patent for such a machine was taken out in France, but for some years no development of the idea was made in England. It is of interest to note that Mr. W. Clark, Chief Engineer to the Municipality of Calcutta, designed, in the year 1863, a steam road-roller. In 1866 a firm of contractors harnessed one of Messrs. Aveling & Porters' traction engines to a 10-ton road-roller, and this firm at once developed the idea of producing a steam roadroller, and in 1867 they supplied one of 30 tons to the Liverpool Municipal Authority. Improvements in construction quickly followed, and early this century British made steam road-rollers were to be found in every part of the world where roads and western ideas of civilization synchronized.

**Acknowledgement.**—The editor thought this accounts of road rolling in Great Britain interesting enough to reprint from "The King's Highway," London, England, of December 30, 1939.

**Highways of the World**—A survey of the world's highway conducted under the direction of B. P. Root, Chief, Highways Section of the Automotive-Aeronautics Trade Division of the U. S. Bureau of Foreign and Domestic Commerce, shows that the number of motor vehicles registered in the world has increased in the last ten-year period from 35,127,398 in 1930 to 43,819,929 on Jan. 1, 1939. During this same period world highway mileage has increased from 6,582,001 to 10,036,233. Relatively, the increase in highway mileage has been greater than in the number of motor vehicles registered. The following table from Automotive Trade News of Jan. 20 shows the world's highway mileage and motor vehicle registrations for the past 10 years.

Year	Highway Mileage	Motor Vehicles
1930	6,582,001	35,127,398
1931	7,805,629	35,805,632
1932	7,959,193	35,263,397
1933	8,994,034	33,567,295
1934	9,152,282	33,562,059
1935	9,270,052	35,355,310
1936	9,599,149	37,454,809
1937	9,687,118	40,560,167
1938	9,731,986	43,078,630
1939	10,036,233	43,819,929





### CONSTRUCTING BITUMINOUS

Bituminous macadam road construction by the penetration method has been employed extensively on the Rhode Island State Highway System. The technique employed by this state today in building bituminous macadam highways is the result of an experience involving more than 2,500,000 sq. yd. of this type of

No. 1—The prepared graded sub-base of dual pavement was compacted to the determined levels and lines. The care in preparation of this base to proper surface is a big factor in the proper placing of the following courses.

No. 2—The local crushed aggregate base consisted of an acceptable graded gravel passing a screen from 4 in. down to 1 in. to be sand filled.

No. 3—The stone base was filled with a sand or stone dust and is preferably filled with more than one operation to permit this filler to work its way to the bottom stone and bond them. No excess of sand is allowed on the surface, as too much sand renders it liable to pad.

No. 4—After stone base is filled and cleaned of the excess sand or filler, it should show a clean mosaic surface ready for the placing of the wearing course.

No. 5—A high grade of trap rock that will pass a square-opening screen from  $2\frac{3}{4}$ -in. to  $1\frac{1}{4}$ -in. was placed directly on the clean sand-filled base to a thickness of approximately  $3\frac{1}{4}$  in., to have a compacted thickness after penetration of  $2\frac{1}{2}$  in.

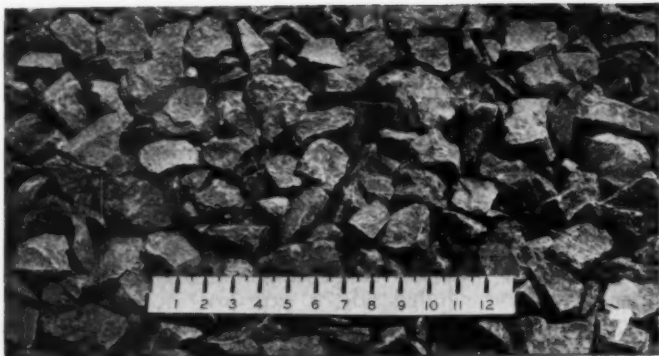
No. 6—A long stretch of trap rock wearing course in place ready for the application of the hot asphalt.

No. 7—A detail photo of a high grade of trap rock uniform in size, clean and with sharp edges.

No. 2—Hot asphalt of 85 to 100 penetration was applied







### MACADAM ON PUTNAM PIKE

construction. M. M. Cranston, Engineering Construction Photographer of the Division of Roads and Bridges of the Rhode Island Department of Public Works, contributes the accompanying series of photographs, which go step by step through the construction of a typical bituminous macadam surface on a section of Putnam Pike.

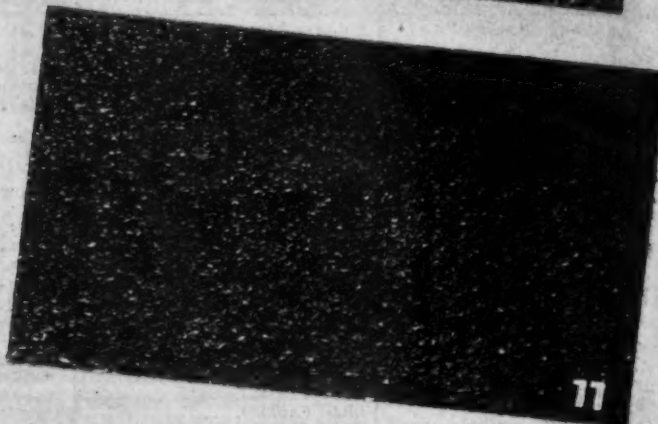
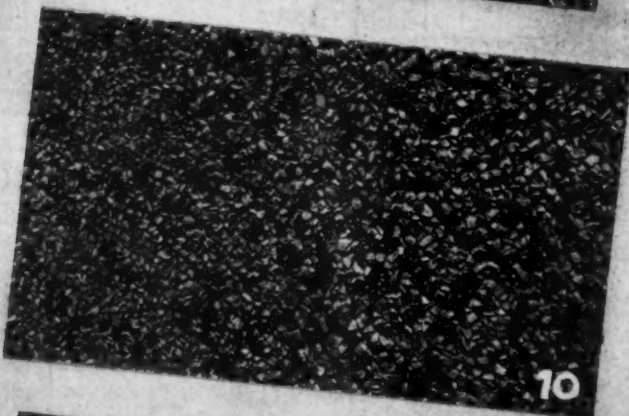
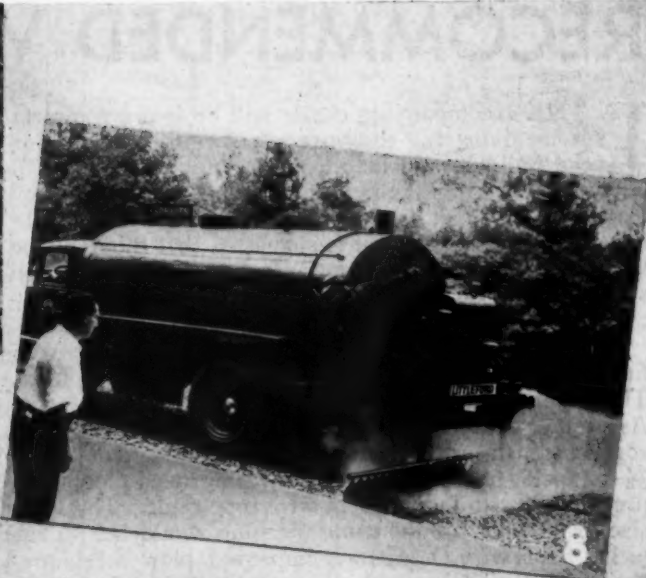
to the trap rock with an approved pressure distributor. The quantity of asphalt for this first penetration was  $1\frac{3}{4}$  gal., cold measure. This application was immediately covered with a clean trap rock passing a square screen  $\frac{3}{4}$ -in. to  $\frac{1}{2}$ -in. This was then rolled and compacted to a tight surface, the cover stone filling the voids in the wearing course stone.

No. 9—A uniform application of hot asphalt was given the wearing course, each stone and the voids having a proper coating of the bitumen with no puddling or excess.

No. 10—The penetration course is covered with a clean trap rock passing a square screen  $\frac{3}{4}$ -in. to  $\frac{1}{2}$ -in., each stone filling a void and making a tight surface, which was rolled until becomes smooth and compact.

No. 11—A seal coat was applied by a pressure distributor at the rate of 6/10 to  $\frac{3}{4}$  gallons per square yard. This seal coat was then uniformly covered with clean trap rock passing a square screen  $\frac{1}{2}$ -in. to  $\frac{3}{4}$ -in. The surface was then rolled and finished.

No. 12—The finished surface of the dual pavement on Putnam Pike consisting of 25-ft. centerlane of bituminous macadam constructed with Texaco asphalt, with 2 outside 11-ft. lanes of concrete. An outside strip of pre-mixed bituminous surface 30 in. in width provides a hardened shoulder so that traffic can turn off the concrete lane temporarily with a feeling of safety.



# RECOMMENDED WIRE ROPE LINES

IN THE accompanying charts will be found complete specifications for the wire ropes needed on major road building and maintenance equipment. Since to our knowledge this is the first time such essential information has been so condensed in tabular form and published in any periodical, it is suggested that this table be kept for permanent reference. It lists the information so that one in doubt as to what rope to use can refer to table to find what wire rope manufacturers recommend.

In explanation of the table, let us look at the very first rope listed—that of a hoist rope on a back filler. These ropes vary in diameter from  $\frac{1}{2}$  in. to  $\frac{3}{8}$  in. Assuming your machine requires the  $\frac{3}{8}$  in. diameter rope, then the specifications for this line would be:  $\frac{3}{8}$  in., 6x19, filler-wire, regular lay, improved plow steel, preformed, with independent wire rope center. The large size drag cable for the same machine would be:  $\frac{3}{4}$  in., 6x16, filler wire, Lang lay, improved plow steel, preformed with independent wire rope center.

The numerals "6x19", "6x16", "8x19", "6x25", etc., indicate the number of strands in the rope and the number of wires in each strand respectively. "6x19", for instance, means 6 strands of 19 wires each. While there

are a great many different constructions of wire rope, on road machinery the great majority of wire lines are of three constructions: Filler Wire, Seale, and Flattened Strand. The accompanying illustrations of rope cross-sections show the difference in construction. From these cross-sections it becomes readily apparent why Seale construction (having large diameter outer wires) is usually recommended where excessive abrasion is encountered.

Excessive abrasion is further successfully combatted by "Lang lay" construction. "Lang lay", as opposed to regular lay, is a rope wherein the wires in the strands are laid in the same direction as the strands in the rope. This construction affords the outer wires a much larger bearing surface than regular lay, wherein wires in each strand are laid in direction opposite to that of the strands in the rope, and thus withstands abrasion longer.

From these tables it will be noted that, for the most part, improved plow steel is the grade of rope recommended; also that preformed rope is largely recommended. Improved plow steel is the harder, tougher material, capable of withstanding the severe work imposed by most applications. Preforming gives rope

## RECOMMENDED LINES FOR ROAD CONSTRUCTION AND MAINTENANCE EQUIPMENT

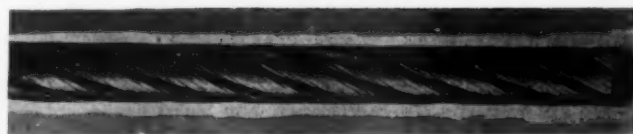
EQUIPMENT	DESCRIPTION OF THE LINE	DIAMETERS IN INCHES	No. OF STRANDS	WIRES PER STRAND	CONST.			LEFT LAY	LANG LAY	GRADE				PREFORMED	NON-PREFORMED	ARMORED	HEMP	CORE	
					FILLER WIRE	SEALE	FLATTENED STRAND			IMP. FLOW STEEL	PLOW STEEL	MILD FLOW STEEL	CAST STEEL					INDEPENDENT WIRE ROPE CENTER	
BACK FILLER	HOIST ROPE	$\frac{1}{2}$ to $\frac{3}{8}$	6	19	X					X				X				X	
	DRAG CABLE	$\frac{1}{2}$ to $\frac{3}{8}$	6	19	X					X				X				X	
	DRAG CABLE	over $\frac{3}{8}$	6	16	X				X	X				X				X	
	DRAG CABLE (Optional)	over $\frac{3}{8}$	6	25			X			X				X				X	
	BOOM HOIST		6	19	X					X				X			X		X
BLAST HOLE DRILL	DRILLING LINE	$\frac{3}{8}$ & $\frac{3}{4}$	6	19	X			X				X		X			X		X
	SAND LINE	$\frac{3}{8}$ & $\frac{3}{4}$	6	7								X		X			X		X
CONCRETE MIXERS	MAIN HOIST	$\frac{1}{2}$ to $\frac{3}{8}$	6	19							X			X				X	
	SKIP HOIST	$\frac{1}{2}$ to $\frac{3}{8}$	8	19							X			X				X	
CONTRACTORS HOIST	HOIST ROPE	$\frac{1}{2}$ to $\frac{3}{4}$	6	19	X					X				X				X	
CRANES (Clamshell) Holding and Closing Lines are governed by the type of bucket.	MULTIPLE REEVE BUCKET	$\frac{1}{2}$ to 1	6	19	X					X				X				X	
	POWER WHEEL BUCKET	$\frac{3}{8}$ to 1	6	19	X					X				X				X	
	LEVER OR POWER ARM BUCKET	$\frac{3}{8}$ to $1\frac{1}{2}$	6	19	X				X	X				X				X	
	ORANGE PEEL BUCKET	$\frac{1}{2}$ to $\frac{3}{4}$	6	19	X					X				X				X	
	BOOM LINES	$\frac{1}{2}$ to $\frac{3}{8}$	6	19	X					X				X				X	
	TAG LINES	$\frac{3}{8}$ to $\frac{1}{2}$	8	19							X			X				X	
DERRICKS	HOLDING & CLOSING & HOISTING	$\frac{1}{2}$ to 1	6	19	X					X				X				X	
	HOLDING & CLOSING & HOISTING	$\frac{1}{2}$ to 1	6	19		X				X				X				X	
	SWING LINES	$\frac{1}{2}$ to $1\frac{1}{2}$	6	19	X				X	X				X				X	
	SWING LINES (Optional)	$\frac{1}{2}$ to $1\frac{1}{2}$	8	19	X					X				X				X	
	BOOM	$\frac{1}{2}$ to $\frac{3}{8}$	6	19	X					X				X				X	
	GUYS	$\frac{1}{2}$	1	7	GALVANIZED	VAN LVA NIZED	IZE D 8	TR	AN	D				X				X	
	GUYS	$\frac{3}{8}$ to 1	6	7	GALVANIZED	VAN LVA NIZED	IZE D 8	TR	AN	D				X				X	
	GUYS	over $1\frac{1}{4}$	6	19	GALVANIZED	VAN LVA NIZED	IZE D 8	TR	AN	D				X				X	
DITCHERS	WHEEL TYPE	Hoist	$\frac{3}{8}$ to $\frac{3}{4}$	6	19	X				X				X				X	
	LADDER TYPE	Hoist	$\frac{1}{2}$ to $\frac{3}{4}$	6	19	X				X				X				X	
		Crowd	$\frac{1}{2}$ to $\frac{3}{4}$	6	19	X				X				X				X	
		Conveyor Hoist	$\frac{3}{8}$ to $\frac{1}{2}$	6	19	X				X				X				X	
	TRENCH HOE	Hoist	$\frac{1}{2}$ to $\frac{3}{4}$	6	19	X				X				X				X	
	OR PULL SHOVEL	Drag	$\frac{3}{8}$ to $\frac{3}{4}$	6	19	X			X	X				X				X	
		Drag (Optional)	$\frac{3}{8}$ to $\frac{3}{4}$	6	25			X		X				X				X	
	Trip Cable	$\frac{1}{2}$ to $\frac{1}{2}$	8	19						X				X				X	
DRAGLINES	HOIST, Single Part Line	under $1\frac{1}{2}$	6	19	X					X				X				X	
	HOIST, 2 or more part of line	over $1\frac{1}{2}$	6	19	X					X				X				X	
	DRAG CABLE	under $\frac{3}{4}$	6	19		X				X				X				X	
	DRAG CABLE	$\frac{3}{8}$ to $1\frac{1}{2}$	6	16	X					X				X				X	
	DRAG CABLE	over $1\frac{1}{2}$	6	16	X					X				X				X	
	(Where Flattened Strand is Preferred)	$\frac{3}{8}$ to $1\frac{1}{2}$	6	25			X			X				X				X	
	BOOM LINES		6	19	X					X				X				X	

## RECOMMENDED LINES FOR ROAD CONSTRUCTION AND MAINTENANCE EQUIPMENT

EQUIPMENT	DESCRIPTION OF THE LINE	DIAMETERS IN INCHES	No. OF STRANDS	WIRES PER STRAND	CONST.			LEFT LAY	LANG LAY	GRADE				PREFORMED	NON-PREFORMED	ARMORED	CORE	
					FILLER WIRE	SEALE	FLATTENED STRAND			IMP. PLOW STEEL	PLOW STEEL	MILD PLOW STEEL	CAST STEEL				INDEPENDENT WIRE ROPE CENTER	
DRAG SCRAPERS	DRAG CABLE.....	$\frac{3}{4}$ to $\frac{5}{8}$	6	19		X					X			X			X	
	TAIL ROPE.....	$\frac{3}{4}$ to 1	6	16	X					X				X			X	
DREDGE (Clamshell)	HOLDING LINE.....	$\frac{3}{4}$ to 1 $\frac{1}{4}$	6	19	X					X				X			X	
	CLOSING LINE.....	$\frac{3}{4}$ to 1 $\frac{1}{4}$	6	19	X					X				X			X	
	CLOSING LINE (Optional).....	$\frac{3}{4}$ to 1 $\frac{1}{4}$	6	25			X			X				X			X	
	CLOSING LINE (Optional).....	$\frac{3}{4}$ to 1 $\frac{1}{4}$	6	19	X				X	X				X	X		X	
	ANCHOR CABLES.....	$\frac{3}{4}$ to 1	6	19		X					X				X	X		X
DREDGE (Dipper) Holding and Closing Lines and Anchor Cables as above	HOIST.....	under 1 $\frac{3}{4}$	6	19	X				X	X				#				X
	SWINGING AND BACKING.....	1 $\frac{1}{4}$ to 2 $\frac{1}{4}$	6	41					X	X				X	X		X	
		under $\frac{3}{4}$	6	19	X					X				X			X	
	SPUD HOIST.....	1 to 1 $\frac{1}{4}$	6	22	X					X				X			X	
DUMP WAGONS		$\frac{1}{2}$ to $\frac{3}{4}$	6	19	X				X	X				X				X
	For more flexibility.....	$\frac{1}{2}$ to $\frac{3}{4}$	6	37						X				X				X
PAVERS	SKIP HOIST.....	$\frac{3}{4}$ to $\frac{3}{4}$	8	19						#				X			X	
	MAIN HOIST.....	$\frac{3}{4}$ to $\frac{3}{4}$	6	19						#				X			X	
	BOOM LINE.....	$\frac{3}{4}$ to $\frac{3}{4}$	6	19						#				X	X		X	
	BUCKET CABLE.....	$\frac{3}{4}$ to $\frac{3}{4}$	8	19		X				#				X			X	
SCRAPERS (Carrying Type)		$\frac{1}{2}$	6	19	X				X	X				X				X
		$\frac{1}{2}$	6	25			X			X				X				X
SEWER CLEANER	HOLDING AND CLOSING.....	$\frac{3}{4}$ to $\frac{3}{4}$	18	7							X			X				
SHOVELS	HOIST LINE.....	$\frac{1}{2}$ to 1 $\frac{3}{4}$	6	19	X				X	X				X				X
	6 x 41 is Optional to 6 x 19FW.....	1 $\frac{1}{4}$ to 1 $\frac{3}{4}$	6	19	X				X	X				X				X
	Multiple Part Hoisting Line.....	over 1 $\frac{3}{4}$	6	41					X	X					X			X
	BOOM LINE.....	$\frac{1}{2}$ to $\frac{3}{4}$	6	19	X					X								
	BOOM LINE.....	over $\frac{3}{4}$	6	19	X					X								
	TRIP CABLES.....	$\frac{1}{4}$ to $\frac{1}{2}$	8	19							X						X	
	THRUST, RACK AND CROWD.....	$\frac{3}{4}$ to 1	6	19	X				X	X				X			X	
	" (For small sheaves).....	$\frac{3}{4}$ to 1	6	41					X	X				X			X	
	SWING LINE (on Chain Hoist).....	$\frac{3}{4}$ to 1 $\frac{3}{4}$	6	19	X				X	X				X			X	
" " Optional.....		8	19		X				X				X			X		
SAFETY GUYS	ON STEAM, ELECTRIC AND DIESEL SHOVELS	under 1 $\frac{3}{4}$	6	19	X					X				X				X
		over 1 $\frac{3}{4}$	6	37						X				X				X
SKIMMER	HOIST OR BOOM CABLE.....	$\frac{1}{2}$ to $\frac{3}{4}$	6	19	X					X				X				X
	PULL OR BUCKET CABLE.....	$\frac{3}{4}$ to 1	6	19	X				X	X				X				X
	TRIP CABLE.....	$\frac{1}{4}$ to $\frac{1}{2}$	8	19							X			X			X	
STUMP PULLER		$\frac{3}{4}$ to 1	6	19	X					X				X				X

greater flexibility and fatigue resistance, and so is more and more being specified for road machinery. In the column under "Preformed" there appears two symbols which are explained as follows: Where the asterisk (\*) appears preformed rope is optional with non-preformed (either may be specified), depending on the relative activity of the boom. The pound symbol (#) indicates a similar option; either preformed or non-preformed may be used, depending on local conditions.

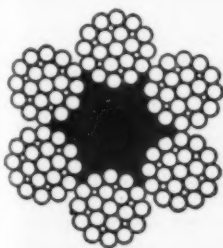
In the columns indicating whether the rope should have a hemp core or independent wire rope center, the double-asterisk symbol (\*\*) appears and this means that independent wire rope center should be specified if the



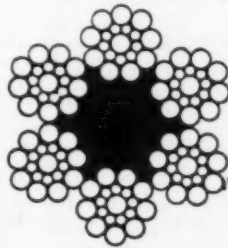
Badly Worn Lang Lay Rope, Showing How Outer "Crown" Wire Have Longer Bearing Surface and So Resist Abrasion

rope is subject to crushing on the drum. Under the heading of pavers, there appears the fourth symbol (\*\*) under the improved plow steel column. In this single instance it is optional whether improved plow steel or plow steel rope is used.

When installing a new rope on any machine care should be taken to gauge the grooves of drums and sheaves. The treads of sheave grooves frequently become worn to corrugations which fit the old rope (but not the new rope), or to an ill-fitting contour. A sheave groove that pinches a new rope will cause excessive wear. A groove that is too large for the new rope will permit the rope to flatten. Watch the sheaves when reeving a new rope. Sheaves are much less expensive than rope and should be discarded before they prematurely shorten the life of a wire line. Rope in itself is a machine. Treat it as such.



6 x 19  
Seale



6 x 19  
Filler Wire



# OBSERVATIONS BY THE WAY

By  
**A. PUDDLE JUMPER**



¶ Herewith a new outfit, at least to me. It was widening the snow-cleared roads over Monarch Pass, Colorado. Monarch Pass crosses the Continental Divide at an elevation of 11,312 ft. west of Salida, Colo., on U. S. 50. All Colorado main routes have been kept open all winter with no loss of travel time for the motorist say the highway engineers. The unit shown herewith is a two-wheel trailer type rotary plow. It is towed behind a truck on which

a side push-plow is usually mounted. The bottom picture shows the widening job completed until the next storm. Other outfits, I was told, have a slice bar attached to the truck body to cut down high snow banks. Doug Stuart, Maintenance Engineer, speaks highly of this unit.

¶ Well! we guessed wrong again, but so did 6,498 other people. No less than 6,500 people at the 1940 Road Show entered the weight estimating contest which was run in connection with the exhibit offered by Mack Trucks, Inc. The object of this contest was to determine the exact weight of a load of crushed rock carried by a Mack model FJ Diesel truck which was featured prominently in the Mack exhibit. After going through the returns filed by this large number of contestants it was found that Mr. L. E. Klingensmith of the Cass Construction Co. of Dederick, Mo. was the winner of this contest. He estimated the weight at 26,870 lb., which is remarkably accurate, since his estimate was within 2 lb. of the actual weight of 26,868 lb. For winning this contest Mr. Klingensmith will receive a prize consisting of a set of four passenger car tires of whatever make and size he requires.

¶ Herewith is a kodak picture showing a device being used in District 16 of the Texas State Highway Dept. for screening the salvaged cover material which is to be used later for covering pavements which bleed during the summer months. As shown in the picture, the excess cover material is broomed or bladed into small stock piles near the edge of the pavement, after which the truck with a driver and three laborers pick it up and later place in storage piles for future use. The screen



is of hardware mesh and two men shovel the material from the roadway directly onto the screen from where the material is raked and shoveled into the truck by a laborer on top of the truck. The salvaged material, when replaced on the roadway, is just as good or better than the original material as all of the fines are removed. There is no question but that fines in cover material are objectionable as an excess of this material will result in slick pavements.—M. B. Hodges, Maintenance Engineer.

## THAT'S WHAT OLD CAESAR DID

When Caesar took a westward ride  
And grabbed the Gauls for Rome,  
What was the first thing he did  
To make them feel at Home?  
Did he increase the people's loans,  
No! he dug in and built good roads—  
That's what old Caesar did.

He built good roads from hill to hill,  
Good roads from vale to vale;  
He ran a good-roads movement  
Till Rome got all the kale.  
He told the folks to buy a home,  
Built roads their ruts to rid,  
Until all the roads led to Rome,  
That's what old Caesar did.

And, if our Nation wants to be  
The center of the map,  
Where folks will want to settle down  
And live in plenty's lap;  
If this broad land its own abodes  
Of poverty would rid,  
Then let us plan and build good roads,  
Just like old Caesar did!



## HIGHWAYS OF HISTORY



1846—FIRST PLANK ROAD

☛ With railroads east of the Mississippi far in the lead in the transportation race, feeble experiments were tried to better wagon roads. The first plank road, opened to travel in 1846, from Syracuse to Oneida Lake, New York, lasted like its successors about ten years before it rotted away.



1850—"DARK AGES"

☛ By 1850 the speed of the fastest trains averaged about twenty-five miles an hour and railroads were carrying passengers and freight over long as well as short distances. Conestoga-wagon and stagecoach companies were failing and the highways were often muddy, rough, and well-nigh impassable.



1857—CAMEL EXPRESS

☛ To speed news to the California gold region, a "Lightning Dromedary Express" was placed on the route from Albuquerque to Los Angeles, in 1857. The experiment failed partly because the easy-going camels imported from Egypt and Arabia provoked the anger of the impetuous American mule drivers.



1860—PONY EXPRESS

☛ The Pony Express, first overland mail service from St. Joseph, Missouri, to California, brought San Francisco ten days nearer to New York. Out-done after sixteen months, in 1861, by the Pacific telegraph line, the messages carried by the riders helped to preserve the Union at the outbreak of the Civil War.



1869—U. P. JOINS C. P.

☛ Nine years later the junction of the Union and Central Pacific railroads at Promontory Point, Utah, captured the business of the eight-year-old stage-coach lines that had shifted because of the Civil War from the southern ox-bow route to the central road between the Mississippi River, Denver, and the Pacific Coast.



1892—BICYCLING DAYS

☛ A generation came to manhood and found its country roads in truly wretched state. Four million devotees of the "safety," often in the "Nineties" found cross-road signs puzzling, maps unintelligible, and farmers indifferent to their plight. Weary and lost this feminine cyclist thought of her sailor hat.



1900—HORELESS CARRIAGE

☛ The breaking dawn of the twentieth century discovered another new thing upon the highways—a horseless carriage: Propelled by newly-discovered internal combustion engines, the pioneer "benzine buggies" had many a mechanical defect to tax the patience and the ingenuity of their drivers.



1911—CROSS-COUNTRY TOUR

☛ The first transcontinental motor-vehicle tour was made in 1911. A Saurer motor truck, called the "Pioneer Freighter," weighing seven tons loaded, covered the fifteen-hundred-mile run from Denver to Los Angeles in sixty-six days. The four-man crew reported great need of road improvement in the Southwest.



1916—THE STATE LINE

☛ Fostered by State aid since the advent of the bicycle, good roads had been extended by 1916 to the boundaries of some States, where travelers often found their progress halted by lack of similar initiative in the adjacent State. To promote improvement of interstate routes Congress passed the Federal-aid Road Act.

It is estimated that the agricultural products from a half-million acres are used in the production of each 1,000,000 automobiles.

# American Road

WASHINGTON, D. C.

## ROAD BUILDERS CHOOSE SOURS TO

### Down the Road

by CHARLES M. UPHAM

*Engineer-Director,  
American Road Builders' Association, Washington, D. C.*

#### ROAD SHOW RESULTS

A short time ago I mingled and talked with members of the most cosmopolitan gathering imaginable. At the same time, I saw road-building equipment valued at \$5,000,000. Enormous machines, weighing 70 and 80 tons, dramatically contrasted with the smallest of precision instruments. This equipment covered eight and one-half acres of floor space in Chicago's International Amphitheater. I envisioned broad straight road-ribbons of progress, criss-crossing the land, stimulating commerce and promoting cultural and social relations. This was my experience at the 37th annual Convention and Road Show of the American Road Builders' Association.

That greatest of all events in the highway world attracted 47,300 members of the highway industry and profession from all of the 48 states and 36 foreign countries. They assembled to discuss plans for the roads of the future and to preview the machinery and materials designed to build an American system of modern motorways.

I was busy all day with Road Show-Convention activities. But one night, for a brief while, I slipped away alone to the semi-dark Amphitheater, to think about this huge road-building exposition in terms of resulting values to the people who use, pay for and own the highways. For, in the final analysis, this gigantic conclave was staged for the public benefit.

I looked at a huge excavator that will handle 45 cubic yards of earth in one bite. But my initial thoughts did not turn to the super-highways that will be built at an early date. I considered what the

ARBA Road Show-Convention means to the farmer. I thought of America's secondary road system, the farm-to-market roads that are the sole links with the near-by community for most rural folks. Earlier that day I participated in a county highway officials' session where a plan for a superior system of secondary roads was formulated. Sixty per cent of America's 30,000,000 farm people live on unimproved dirt roads. Imagine the beneficial effect the 1940 Road Show-Convention will have on America's system of rural roads!

The benefits of road building to the nation as a whole next concerned us. A major industry, the construction, repair and maintenance of roads keeps hundreds of thousands of men at work. Over 100,000 miles of our primary highway system are obsolete and 10,000,000 motor vehicles will be added to the present total of 30,000,000 within the next ten years. I thought of the road builders gathered in Chicago to coordinate plans for tomorrow's adequate highway system. The construction of new highways will do more to revitalize industry and provide employment than any other single project.

I had one more thought before leaving the International Amphitheater that night. Delegates from the Latin American countries visited the ARBA Road Show-Convention in record-breaking numbers. A plan was adopted to advance the completion of the Pan-American highway. So, lastly, I saw the realization of this life-line between the two Americas—promoting better commercial, social and cultural relations and inestimable good-will!

#### NATIONAL AUTHORITIES ADDRESS ARBA BANQUET

Headlining the list of distinguished speakers at the annual banquet of the American Road Builders' Association were Federal Works Administrator John M. Carmody, Oklahoma Congressman Willburn Cartwright, "Business Week" Publisher Willard Chevalier and Columbia Commentator H. V. Kaltenhorn. Approximately 1,400 ARBA Road Show-Conven-tion delegates attended the banquet at the Stevens Hotel, Chicago.

Mr. Carmody, one of the federal government's most vigorous good roads exponents, strongly favored an increased program of highway construction. He called attention to the national highway-planning survey, being undertaken by the Public Roads Administration in co-operation with 46 states and the District of Columbia. As a result of the survey, the administration has recommended a system of interregional highways to link industrial and population centers.

Congressman Cartwright, as co-author of the Hayden-Cartwright federal-aid highway legislation, was well equipped to give Road Builders an insight into the national highway picture. Colonel Chevalier, ARBA past president, spoke of the relationship of highway construction to business. He pointed out that an extensive road-building program would far toward solving America's unemployment problem and that many and varied American industries derive great benefits from the building of roads.

"Let's Look at the War," said H. V. Kaltenhorn, known to radio listeners from coast to coast. Before telling the inside story of the European struggle, Mr. Kaltenhorn discussed military roads. He spoke of Germany's swift subjugation of Poland through the use of the German system of super-highways, built primarily for military purposes.

ARBA President Murray D. Van Wag-ner read a message to the Convention from the President of the United States. A message from Arizona Senator Carl Hayden, who was unable to attend, was read by ARBA Engineer-Director Charles M. Upham. Senator Hayden wrote that he was co-operating to the fullest extent with American road builders for the advancement of an adequate system of highways.



# Builders' Review

MARCH, 1940

Last year there were more than 3,000 accidents between trains and motor cars in which some one was killed or injured.

## LEAD THEM FOR NEXT TWO YEARS



### ROAD BUILDERS CHOOSE SOURS TO LEAD THEM FOR NEXT TWO YEARS

Hal G. Sours, assistant director and chief engineer, state department of highways, Columbus, Ohio, was elected president of the American Road Builders' Association at the 1940 Road Show-Convention. Mr. Sours was unanimously chosen to succeed Murray D. Van Wagoner, Michigan state highway commissioner. He will take office at the ARBA May Meeting in Washington, D. C. A member of the ARBA for 12 years, Mr. Sours is a past president of the County Highway Officials' Division and a member of the executive committee.

Born on a farm at Manchester, Ohio, he is a graduate of the University of Akron. He served the state highway department as maintenance engineer and resident engineer from 1919 to 1925. In 1924 he was elected county engineer for Summit County and was re-elected in 1928 and 1932. He also served the highway department as resident engineer in charge of all state work in the county. The ARBA president-elect is a past president of the Ohio Engineering Society and the County Engineers Association of Ohio. He also served the Ohio Engineers Registration Board as chairman and is national director of the Ohio Society of Professional Engineers.

Col. Robert S. Beightler, Ohio director of highways, declared that "the election of

Mr. Sours as president of the American Road Builders' Association is a source of gratification to me. It proves that in a very short time Ohio has been recognized as a center of sound highway administration."

### ALABAMA ROAD BUILDERS HEAR UPHAM AND SLEE

Congressman Henry Steagall of Alabama, chairman of the House Banking Committee, addressed the annual banquet-meeting of the Alabama Road Builders' Association at the Whitley hotel, Montgomery, Ala. He spoke on federal funds for PWA and highway construction. More than 500 state, county and city officials; contractors, material producers and equipment distributors attended the conclave. ARBA Engineer-Director Charles M. Upham and Assistant Engineer-Director William C. Snee addressed the ARBA affiliate at a luncheon-meeting at the Jefferson Davis hotel.

### VAN WAGONER OPENS ROAD SHOW



ARBA President and Michigan State Highway Commissioner Murray D. Van Wagoner addressed Road Builders at the opening ceremonies of the 1940 Road Show from the balcony of the International Amphitheater. Other honor guests

pictured in the box with him include, left to right, Congressman J. W. Robinson of Utah, Jennings Randolph of West Virginia and Wilburn Cartwright of Oklahoma, chair. of the House Roads Committee, ARBA Past Pres. Willard Chevalier.

# FROM RAILWAY TO HIGHWAY

## How New Hampshire Is Using an Abandoned Railway Grade

By C. M. BROOKS

*Division Engineer, New Hampshire State Highway Department, District No. 2, Laconia, N. H.*

THE DEVELOPMENT of Franconia Notch in the White Mountains of New Hampshire, with the Old Man of the Mountains, Echo Lake and many other points of interest to the vacationist, can be said to have started in 1854 when the famous "Profile House" was built at the head of the notch between Echo and Profile Lakes. For 24 years rough, steep, unimproved mountain roads served this area, and it was over these roads that President Grant made his famous record trip by mountain coach from Bethlehem to the Profile House.

In 1878 the Profile Railroad Company constructed a narrow gauge road from Bethlehem Junction, where it connected with the Boston & Maine Railroad, to the Profile House, a distance of nine miles. The preliminary survey for this railroad was made by the late John C.



*The Railroad at Point Ran Along the Shore of Echo Lake. The Trees Have Been Removed from This Section to Provide a Truck Road for State Forestry Trucks to a Rubbish Dump*



*View of Old Railroad Grade, Showing How Quickly Trees and Brush Reclaim the Old Road Bed After Service on the Railroad Stops. This View Was Taken Before Any Surveys Were Made.*

Chase of Derry, N. H., whose instructions were to lay a 3 percent grade from where the railroad crossed Gale River to Echo Lake. To cross Lafayette Brook it was necessary to build a timber trestle 60 ft. high and about 250 ft. long. In 1915 the narrow gauge was changed to standard gauge and the wooden trestle replaced by a wrought iron trestle.

In 1923 the Profile House burned and in 1924, it being decided not to rebuild, the Boston & Maine Railroad ceased operating the Profile Branch and several years later abandoned the line and removed the rails.

The New Hampshire Highway Department, realizing the value of this right of way with its 3 per cent maximum grade and easy railroad curves, began to take steps to acquire title for future highway purposes. In June 1926 the Profile and Flume Hotel Company, which had acquired the Lafayette Brook trestle as it carried their sewer pipes to the big cesspools, gave the structure to the state. In looking up the old titles it was found that while part of the right-of-way reverted to the original owners and thus had become part of the White Mountain National Forest, there were several miles passing through the government-owned White Mountain National Forest which were still owned by the railroad. In 1930 Frederic E. Everett, State Highway Commissioner, was successful in convincing Governor Winant of the value to the public of this old railroad grade and the state purchased the railroad's holdings for \$500. A section approximately three miles long and four rods wide, from the Bethlehem-Franconia town line to Bethlehem Junction, had been reserved by the



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*This Section Has Been Cleared Out for Survey Work, Also to Provide Access to the Lafayette Trestle for the Painting Crew*

Brown Company of Berlin, N. H., as a logging road. This was purchased in 1934 for \$1, thus giving the state ownership of the entire right-of-way of the old Profile Railroad.

The use of a railroad grade for highway purposes was an innovation in New Hampshire and for ten years, excepting for preliminary surveys and study of the possibilities, nothing was done by the state highway department towards any construction work. For approximately seven miles the old railroad grade parallels that section of highway, U. S. 3, known as the Lafayette State Road. The present highway was originally a logging road and in 1906 was taken over by the State as a State Road. It was never really built, but like Topsy, "just grew." The grades follow the contour of the ground and many are short and steep and the curves are sharp. One section crosses a long swamp area and was built on a log corduroy base. Since the state took over this road it has been improved somewhat with maintenance funds, being given a coat of gravel and surface treated with tar, but it still narrow, only 18 ft. wide in some sections and wholly inadequate to carry the present day traffic.

In 1938 Commissioner Everett, having funds available, designated a section 1.509 miles long from Gale River southerly as a Federal Aid Project. Surveys and plans were prepared and in 1939 the contract was awarded to W. H. Hinman, Inc., for \$67,201. The new road was finished and opened to the public in September.



*View of 1939 Construction Showing the Easy Grades and Attractive Alignment*

ber. The construction was under the direction of John O. Morton, Construction Engineer of the department, and Lucius Aldrich was the resident engineer in charge.

The new road is surface treated crushed gravel 24 ft. wide with 1 ft. shoulders. The minimum grade is 0.89 per cent and the maximum is 2.45 per cent. The maximum curvature is 8 degrees. Two parking areas have been provided for the use of the tourist and the U. S. Forest Service is planning this season to cut out vistas which will open pleasing views to the north.

Plans are now in progress for the construction of the remaining 5.484 miles to Echo Lake together with a "round the lake" road to develop this nationally known beauty spot. The proposed project for some distance follows around the northerly side of Mount Lafayette, the highest mountain in the Franconia Range, and when completed will open up many views of the northern



*View of the New Construction in 1939*

mountains unseen by the users of the present highway. By proper study of the present railroad right-of-way it will be possible to construct a real scenic highway similar to the Skyline Drive in the Great Smoky Mountains which will safely accommodate present and future traffic and, as state highways are now used the year around, can be economically maintained in the winter. With snow often in the mountains from September to May its removal is a real problem to the engineer.

The Lafayette Trestle is at station 69/04 on the new project. The present trestle is 65 ft. above the bed of the stream and is 288 ft. long. As it was designed to carry railroad trains, the deck is only 10 ft. wide. To make it available for highway traffic it will be necessary to widen it. Several plans are being considered but, as the members of the present structure do not meet the requirements of the Public Roads Administration, it may be necessary to wreck it and construct an entirely new structure. At the present time a final decision has not been made.

In 1938 the state highway department constructed a new road at the head of the notch to provide for the increased traffic at the new Aerial Tramway. This road utilized a section of the old railway grade and the proposed project, by leaving the present road opposite the tramway, will further develop this recreational area and improve the parking facilities.

This project is in Division II and the field work is being done by Engineer Henry P. Davis as chief of party, the plans being worked up at the main office in Concord. It is expected that it will be ready to advertise this year and completed and open to the public in 1941.

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# BLACK BASE CONSTRUCTION IN TOPEKA, KANSAS

By W. A. LAWSON

Commissioner of Streets and  
Public Works, Topeka, Kan.

**M**ODERN design and modern construction methods applied to time-proved materials are Topeka's answer to a growing need for an economically justifiable type of street construction. Aggravated base



Fig. 1

conditions in the city's rapidly growing west and southwest residential neighborhood has resulted in accelerated base failures of recently constructed pavements and in an unusual subsidence of the gutters along the edges of the pavement.

The foreground of Fig. 1 shows typical cracking caused by failure of the base design originally employed. As a means for eliminating this cracking and the subsi-

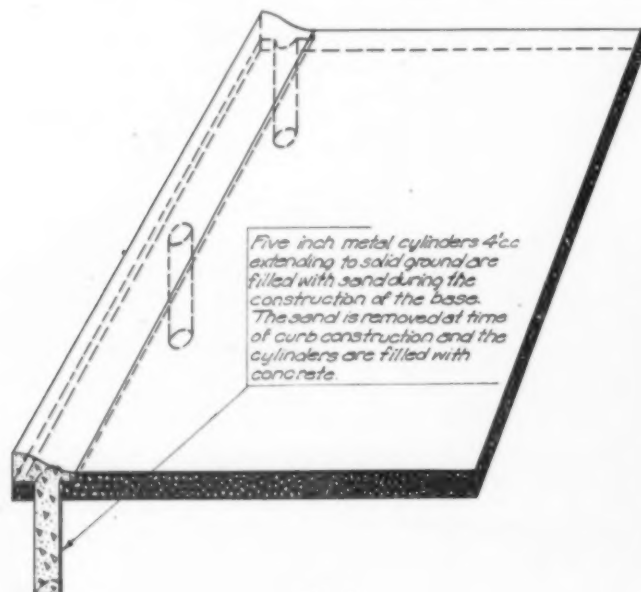


Fig. 2

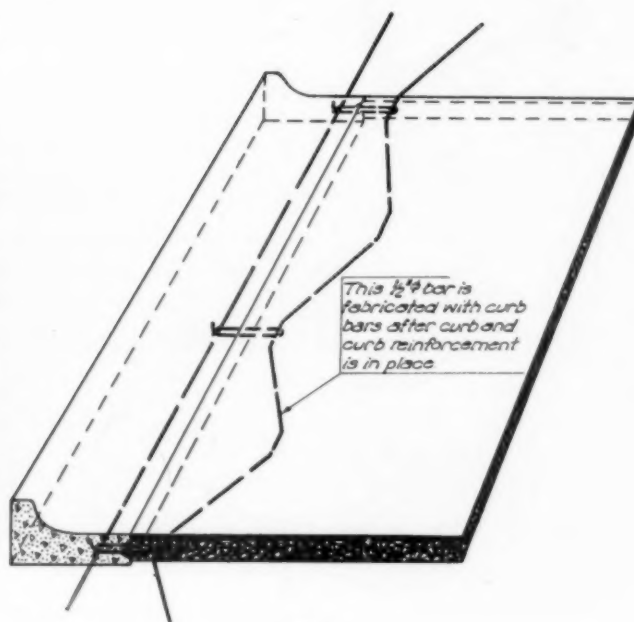


Fig. 3

dence of the curbs, and in the interest of economy and sightliness, W. E. Baldry, City Engineer, developed a narrow concrete curb which is used in connection with an asphaltic concrete base and stone-filled sheet asphalt surface course. Fig. 2 shows the narrow curb with its novel supports.

The contract price of the narrow curb and its supports, complete in place, was 45 ct. per linear foot as compared to 70 ct. per linear foot for the wider curb and gutter. In addition to the advantages before mentioned, the narrow, shallow curbs are expected to produce a wider traveled



Fig. 4





way than would be the case with wide curb and gutter on a street of the same curb to curb width. Ties which were used between the base and the wide curb and gutter sections are shown in Fig. 3.

The ties are designed to avoid planes of cleavage and are particularly adapted to the modern asphaltic concrete base used in the new pavement design. The deformed longitudinal bars are of such dimensions that they can be laced through the loops of the transverse curb and gutter bars after the curb and gutter is in place. The contractor experienced no trouble in placing this reinforcement.

The backgrounds of Figs. 1 and 4 show the new pavement design, the former with the wide curb and gutter, and the latter with the modern narrow type curb. Fig. 5 shows the adaptation of the trend toward narrow curbs applied to driveway construction.

Alternate bids were taken on the asphaltic concrete base with stone-filled sheet asphalt top in competition with the ordinary rigid type. The contract price on the asphaltic type was \$1.10 per square yard, as compared to \$1.50 per square yard for the alternate rigid type. The base course is composed of well graded materials, the actual mix being approximately as follows, by weight:

Screens	Per Cent
Passing 1 in. and retained on ½ in. screen.....	35.8
Passing ½ in. and retained on ¼ in. screen.....	26.7
Passing ¼ in. and retained on No. 10 screen.....	6.0
Passing No. 10 and retained on No. 200 screen.....	23.0
Passing 200-mesh screen .....	4.0
Asphalt .....	4.5
	100.0

The surface course is composed of fine material or aggregate, filler, and bitumen, of which all aggregate passes the ½-in. screen. The actual surface mix contains approximately 8.2 per cent asphalt cement, 10 per cent dust, 66.8 per cent sand, and 15 per cent chat.

**Missouri Has 15,571 Miles of State Highways—**  
The state highway system of Missouri totals 15,571 miles of various types built since 1920 at a construction cost of \$322,700,000, of which 8,305 are on the trunk system and 7,266 on the supplementary routes. Road types now on the state road system include:

	Miles
Graded earth .....	153
Oiled earth .....	116
Granular .....	8,652
Bituminous .....	2,636
Concrete .....	4,015
Total .....	15,571



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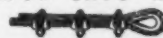
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*Merritt Parkway at Greenwich, One Mile West of Round Hill Road, Showing Older Landscaping Which Escaped Hurricane Damage*  
938

## THE MERRITT PARKWAY

### How the Recently Completed 34 Mile Ultra Modern Automobile Highway Is Functioning

By C. G. NICHOLS

*Executive Deputy Commissioner,  
Connecticut State Highway Department*

CONNECTICUT'S Merritt Parkway is the first link in what is planned to be a comprehensive parkway system for the entire state. With less than four miles to go to its eastern terminus—the new Housatonic Bridge between the Towns of Stratford and Milford—the Merritt Parkway is already operating as an ultra-modern highway for 34 miles. It carries traffic from the New York state line to the village of Nichols, free of all the thickly settled communities that line the Connecticut shore and the Boston Post Road in Fairfield County.

The degree to which the Parkway relieves the local traffic strain in the cities of Stamford, Norwalk and Bridgeport and the intermediate towns is illustrated by the count of cars passing through the toll station. In the first eight months of operation of this station, three and a third million cars passed through it—and two of those months were in the mid-winter season of reduced motor car travel.

The Parkway was designed and built to eliminate all "bottle-necks" and, in operation, has succeeded in this aim. The deliberation with which it was developed permitted the inclusion of almost every ideal of modern highway design, certainly every ideal that could be used in the territory served and the traffic problems generated by that territory.

The first problem in the series that culminated in the Merritt Parkway, was the strangling congestion that came to the Boston Post Road during and immediately after the first World War. This highway which served

to connect the industrial centers of Connecticut and the rest of New England with the Port of New York might well be said to be the birth place of major inter-city truck traffic. Raw materials into New England and finished products from it—an ever mounting flow of passenger automobiles crowded every mile.

Seeking remedies, the Connecticut State Highway Department determined early that an alternate route was needed. When this decision was reached, work was undertaken to widen the Post Road from the New York state line to New Haven. It was next decided that a new route for trucks was not practical since US Route No. 1 served all of the settled industrial areas and these spots were developing the truck travel. At the same time a survey revealed that a shore line highway was impractical because of the large number and age of settled areas along the proposed route. Aside from the cost of property, many of the existing "bottle-necks" offered exceedingly difficult engineering and construction problems.

It was then that the idea of a new route through comparatively untouched territory was developed. It was further determined that the new route should be designed for the exclusive movement of passenger vehicles. From this point action leading toward the present Merritt Parkway was continuous.

While the Highway Department had made some land acquisitions in 1926, the first legislative recognition of this specific route came in 1927 when the path was designated in general terms. In 1931 the state highway com-



*Main Street at Stamford, Conn., Showing the Twin Bridges That Are to Carry Merritt Parkway Over the Street*

missioner was authorized to undertake a lay-out of the route and at the same time the general assembly set up a commission to control the use of the road after its completion. Subsequently further authorizations, including a bond issue, were the subjects of legislative action and work was undertaken on the actual grading, paving and landscaping.

Before construction had progressed greatly, traffic surveys revealed that with the completion of the Parkway along the route originally planned, enormous congestion was in prospect at the eastern end. The widened Post Road with its four lanes of traffic and the Parkway with four more lanes were both routed over Washington Bridge between the town of Stratford and Devon in the town of Milford.

Further legislation was passed changing the routing of Merritt Parkway to carry it directly east to the Housatonic River at a point a few miles north of its original terminus. A new bridge was authorized to carry the Parkway traffic over the river and to the east and north. The Wilbur Cross Parkway with lateral connections was authorized at the same time in 1937.

The Wilbur Cross Parkway will carry traffic for central Connecticut cities and Massachusetts while certain of the lateral connections will carry traffic destined for eastern Connecticut and Rhode Island. All of the details on these projects are not settled, but steps in the direction of completing each have been taken, and some stretches are graded and paved for divided lane travel.

While the actual use of the Merritt Parkway is the perfect method of measuring its convenience and pleasurable features, consideration of some of the facts concerning it illustrate its manifold advantages. There are over 50 bridges, separating the Parkway and intersecting highways. The number is almost equally divided between those which carry the Parkway over old roads and those which take the older highways above the Parkway. In each instance the rolling character of the country determined the decision. Connections vary from a complete "clover leaf" permitting entrance and egress on a divided basis for all traffic, to a few grade intersections where present traffic is so small that the cost of a bridge is not justified. In these latter instances future separation will be determined by the increased use of the intersection.

The Merritt Parkway is laid out on a right of way that is 300 ft. or more wide, the extra widths coming where tracts had to be purchased as units to avoid

isolated spots lacking access to any highway. In this connection it should be borne in mind that the Parkway has no private entrances.

The present travel is over two reinforced concrete lanes in each direction, separated by a landscaped dividing strip. Landscaping has also been undertaken on outside strips as well. In all instances where construction permitted, older vegetation was retained and plantings were made with trees and shrubs of varying sizes, to bring about a natural setting.

This landscaping along the older stretches of the Parkway is beginning to reveal its future possibilities, in that center strip planting already obscures traffic in the opposing lane. This of course enhances the rural setting which is preserved by the screen of trees and shrubs on each side of the Parkway.

The practical value of the Parkway is best illustrated by a few facts about traffic movement over it. In the 34 weeks between June 21, 1939, and Feb. 15, 1940, a total of 3,337,507 passenger motor vehicles used the Merritt Parkway. An intersecting side light on the vacation business of New England comes in the break-down of east and west travel.

From the date of opening to Aug. 12 the flow of traffic to the east or into New England exceeded the travel out of New England by 26,515 vehicles. Beginning Aug. 13 and ending Oct. 8 the excess travel was



*A Section of the Merritt Parkway*



westbound and totalled 43,879 vehicles. It may be presumed that the difference between this and the earlier excess of eastbound travel is accounted for to a large degree by the fact that the count did not start until the latter part of June and that prior to that date a great deal of vacation travel into New England had already taken place.

For the present the eastern terminus of the Merritt Parkway will be at its intersection with Connecticut Routes No. 65 and No. 113 in Nichols, Town of Trumbull.

Present construction schedules call for the completion of the new Housatonic Bridge this summer, and with it, completion of at least two of the links to connect the Merritt Parkway with territory to the east of the Housatonic River. The approach from the present terminus at Nichols to the bridge is already under construction, with grading practically completed. To the east of the bridge grading is under way as the first step in connecting the bridge and Parkway traffic with US Route No. 1 on the so-called Milford by-pass.

The eastern end of the Housatonic Bridge not only serves as the connecting point for US Route No. 1 traffic but also for the proposed Wilbur Cross Parkway which is to carry traffic for New Haven, Hartford and points north and east of both of these cities. Two sections of construction looking to the eventual realization of this highway have already been completed. One is a lateral in the Town of South Windsor which will connect the northern Connecticut valley with the Cross Parkway and the other is the progressive lay-out and construction of the Wilbur Cross Parkway in the Towns of Union, Ashford and Willington in the vicinity of the present Hartford-Worcester Road. In each instance this new roadway is of the divided type with two lanes in each direction separated by a landscaped strip, averaging 20 ft. wide.

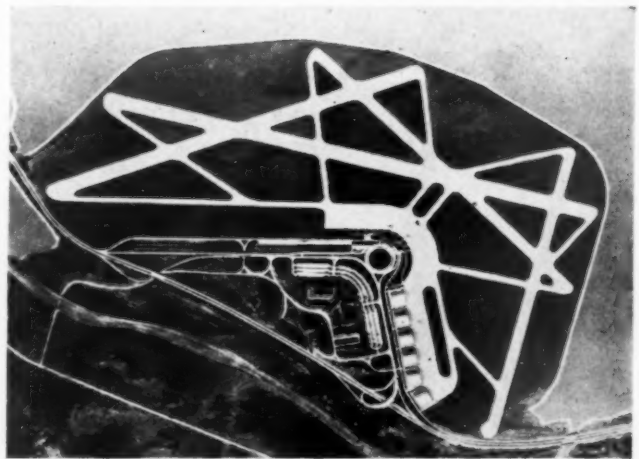
Further divided lane construction south of Hartford is scheduled for the 1940 program of the state highway department, and it is anticipated that the next link of the Wilbur Cross Parkway in Milford will be undertaken in 1941. This latter section will begin at the eastern end of the Housatonic Bridge and go northeast to the New Haven-Derby road.

## 60 MILES PAVING FOR WASHINGTON AIRPORT

Bids were opened March 1 for paving the runways, taxiways and aprons at the Washington National Airport. This work is stated to require the largest quantity of plant produced asphaltic mixtures yet used for surfacing any airport project. Pavement equivalent to 60 miles of 20 ft. highway will be installed at the airport. The main runways are to be 200 ft. and will have a combined length of 21,257 ft.

The airport is located at Gravelly Point on the west bank of the Potomac River. An area in excess of 700 acres has been reclaimed from the river bottom by dredging in more than 18,000,000 cu. yds. of sand and gravel. This subbase has been stabilized preparatory to receiving the asphaltic base and surface courses. Exclusive of the stabilized sub-base of pumped-in sand and gravel which has been primed with a bituminous material, the hot-laid mixture in the base and surface will be  $3\frac{1}{2}$  in. thick.

The runways are scheduled to be completed in 130 calendar days. Access roads, service roads, parking areas and the relocated Mt. Vernon Memorial Boulevard—im-



*Illustration of Model of Washington National Airport*

mediately adjoining the airport—are also to be constructed of asphalt but will be completed some time after the runways. All surfacing operations are to be finished by Nov. 30 of the current year. The parking areas are designed to accommodate 5,000 automobiles and the parking facilities are arranged in step-like formation whereby each parking strip rises 4 ft. above the preceding strip. This will permit visitors to the airport to view the airfield activities with a full vision while sitting comfortably in their automobiles.

The plans were developed by a staff from the Corps of Engineers' District Office at Washington, headed by Colonel R. S. Thomas; a Federal Interdepartmental Engineering Commission, composed of top-ranking engineering officials from the Civil Aeronautics Authority, the Army's Corps of Engineers, Works Project Administration's Chief Engineer—Major B. M. Harloe—also engineers from the Public Works Administration and the Public Buildings Administration served as a joint government agency to review all plans and execution of details required in this airport development.

While Army engineers developed the plans and are supervising all phases of constructing this commercial airport, they do not participate during times of peace in the design and construction of military airfields; the Quartermaster Corps designs and supervises the construction of all military airports.

## CORRECTION

A typographical error occurred in the article "Stabilized Soil Mixtures" in the February issue. This error occurs in the second sentence of the fourth paragraph on the first page. As published, the sentence reads:

"However, they do not give comparable results which have been found particularly useful for the following purposes:"

This should have been:

"However, they do give comparable results which have been found particularly useful for the following purposes:"

**1,173 Men Attend Purdue Road School**—All previous records of registered attendance was broken at the 26th annual Purdue Road School, held Jan. 22-26 at Lafayette, Ind. The total was 1,173, an increase of 76 over last year.

## ANOTHER REASON WHY BRICK COSTS LESS PER YEAR OF SERVICE

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Nor is there damage to brick where these melting materials have been used as an admixture with sand or cinder stock piles.

And, of course, brick best withstands the concentrated chain-shod traffic in snow-rutted roads or streets. The experience records of hundreds of cities and other road building units and many accelerated tests have definitely established that point.

The cost of upkeep on brick pavements is always low, ranging from negligible to nil.

Brick resists damage from weather, traffic and ice-removal material, and thereby gives smooth, safe passage to any type of traffic at the lowest cost per year of service. National Paving Brick Association, National Press Building, Washington, D. C.

# BRICK

FOR NEW CONSTRUCTION AND RESURFACE WORK



# 6,000 YEARS OF RAINDROPS

Reprinted from the Feb. 25 Sunday Magazine of the Los Angeles Times, Los Angeles, Calif.

By ED AINSWORTH

SOME people chase rainbows. But a distinguished engineer of San Marino has just chased raindrops for 6000 years and emerged with a completed "cycle system" of weather forecasting—the most far-reaching and exhaustive in the history of science.

It's so far-reaching it even includes a theory as to the reason for the gigantic surges of the sea which have been wreaking havoc at Redondo and other beaches. This is that the earth will reach a seven-year peak in the earthquake cycle March 8 and that the ocean's disturbances are due to a related peak in electronic bombardment from the sun. The additional volleys of electrons, according to this idea, stir up such violent magnetic whirlpools at the magnetic pole and other magnetic foci and attract so much oxygen that the weather disturbances are world-wide.

The battering seas—akin to the "seiches" or mysterious cyclic surges in lakes such as Lake Geneva—are presumed to be caused by these violent disturbances of the atmosphere "kicking up" the mysterious waves.

This, though, is merely an incidental phase of the "cycle system." The system itself is vast and comprehensive.

It should be. It took some 30,660 hours of intensive labor during 14 years to evolve it.

And now this engineer-physicist-geologist, Halbert P. Gillette, is ready to stake his hard-won professional reputation, for instance, on the prediction that the United States is moving toward the bottom of a "dry" curve and will reach the climax of its worst drouth in 189 years in 1964. Yet, to temper this dire forecast he offers the cheering prospect—if you like to look ahead—of the whole world entering upon a New Golden Age in 2815 A.D. Indeed, he is ready to predict wet and dry cycles with equal impartiality as a result of the enormous amount of research which has produced the "tables of probability" in regard to future weather conditions.

Incidentally, he has riddled the secrets of the past so thoroughly with his cycle formulas that he can tell you whether Confucius needed an umbrella on a certain day in 500 B.C. or whether Lucretia Borgia had clear skies the night she gave the works to No. 3 on her poison list.

Then, not satisfied even with these scientific peeps into the future and past he goes even further and predicts that the "weatherman" of the generations to come will forecast:

- 1.—Rain and dry weather,
- 2.—Earthquakes,
- 3.—Sea movements,

all based upon a common cause.

In this fashion does Gillette present his completed "cycle weather system" based upon evidence just made available to clinch arguments he has been advancing in scientific journals for more than a decade.

Gillette, who after 14 years of the most intensive study on a single subject—but a subject with a thousand ramifications—has just announced his conclusions on the "cycle weather system," is one of America's best-known

civil engineers and author of numerous standard source books on engineering practice and appraisals and costs. He also is head of the Gillette Publishing Co. of Chicago which puts out those standard magazines for the engineering profession, *Roads and Streets* and *Water Works and Sewerage*.

Mr. Gillette is a working physicist, too. He once taught physics in Columbia University. He is a mining engineer graduate from Columbia in addition to his life work of civil engineering.

Of course, most persons now living are more anxious about what is going to happen than in what has happened. That is the reason Mr. Gillette is willing to venture his conclusions in regard to the great drouth which may be expected in the United States in 1964. With customary scientific reserve he doesn't care to say, for instance, that Lake Mead will dry up in 1964. He prefers to declare that if the cycle sticks to schedule, as it has been proved to do for at least the last 6000 years the year 1964 will see the culmination of one of a 189-year record drouth.

Naturally, a man who has evolved a theory of this nature with thousands of pages of hand-written tables of frequency and data to back it up has become known to the meteorological profession in the United States even though he may not be technically of their group. Mr. Gillette is a participating member of the American Meteorological Society and has presented to it various scientific papers on phases of his work as it progressed and has had his material printed in the journal of the society. In fact, his articles on weather cycles during the last 12 years in various technical publications have mounted to a total of 100 or more.

But it has been only recently that there has been available to him what he considers to be the final conclusive long-range proof of the rain cycle figures which he had gathered from various sources in his experimentation and deduction.

This proof is in the nature of a varve.

A varve, it must be explained, is "an annual layer of sediment deposited in a lake or sea."

When varves harden they become rock.

It so happens that a "varve record" dating back to almost 2300 B.C. has been made available to Mr. Gillette out of Lake Saki in the Crimea by Schostakowitch, Russian meteorologist. In effect this is a rainfall record dating back to 1000 years before the oldest of the California Sequoias began to sprout. In other words, more than 1000 years have been added by this discovery to the best known method of rainfall study—that of the counting and analysis of the thickness of annual tree rings.

For many years geologists have been skeptical of the value of varves because they would not concede that they were actually annual deposit. But the Gillette research by comparison of man-made records and of tree-ring records of known authenticity dating back for 3000 years or more has established beyond a doubt that the



# MILLIONS FOR DEFENSE

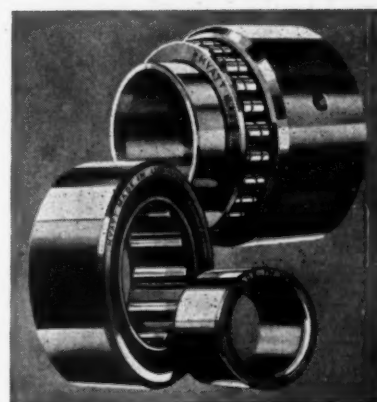
The Hyatt Roller Bearings in equipment like this, on road work and construction jobs, number into millions, and everywhere the same dependable bearing operation is found. That's a REX PAVEMASTER making fast work of this highway building.



**But Not One Cent for Tribute to Friction or Maintenance!**

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varves are extremely accurate "measuring rods" for rainfall in a given year. For one thing, the measurement of an annual alluvial deposit in a lake is likely to be much more trustworthy than a tree ring because a tree is affected by many other factors besides mere rainfall—factors such as heat and cold. Then, too, tree rings become much thinner and much less sensitive to variations in rainfall as a tree grows older. A varve is a varve for all that and is unaffected by anything but rain.

So, for 14 years Mr. Gillette worked with all the available source material plus his own discoveries and deducting ability and then the Lake Saki varves came along to clinch his argument and provide the final conclusive material that he needed.

California, too, provided good varve evidence. This State is "full of varves" with particularly readable ones in the Mono Lake section and in one spot on the Topanga Canyon road off of Ventura Blvd., where the record of several thousand years is available for inspection.

All these helped in completing the cycle data.

But how he arrived at the point where he was ready for the final proof is the real story.

Fourteen years ago Mr. Gillette was at the top of his profession making a large yearly income as a consulting specialist on appraisals and cost estimates in the engineering field, a sphere in which he had pioneered. He was busy, too, with his magazines which he had started many years before and built up to a point of dominance. Suddenly he decided that he was working too hard and killing himself. He turned over his business to his son in Chicago, headed for California, and told all his friends before he left: "I hope I never come back except on a visit."

He and Mrs. Gillette found a place amid the oaks and azaleas of San Marino, and he started to work on a book he long had had in mind. It was called "Research on Research," Mr. Gillette having formed certain ideas in regard to the lack of thoroughness in the ordinary course of what was known as research.

Then he decided that he needed a little more laboratory experience himself in the matter of research. So he started out in 1926 on the study of weather cycles, a subject which had intrigued him. He thought it might take him a couple of years and that then he would be able to finish his book with more thorough knowledge of what he was talking about.

That, as noted, was 14 years ago.

Today Mr. Gillette probably is one of the best qualified men in America on the subject of research, but now he is so interested in weather cycles and the vast region of inquiry which his study of it has opened up that he may never get back to the more academic ground of a mere "Research on Research."

Indeed, the fields of interest which the weather cycle investigations have opened up include everything from the nature and effect of electrons thrown off by the sun through the theories of ice caps over the equator up to and including California earthquakes and the possibility of mankind entering upon the aforementioned Golden Age in 2815, about 875 years from today, in case anybody is interested.

Indeed, Mr. Gillette in starting out to study mere weather cycles has found himself immersed, too, in the whole cultural history of the world, the question of the effect of sunspots and now the whole matter of electrons and their amazing effect upon the human race.

It all starts out with the length of various wet and dry cycles as measured in man-made recordings and in the tree rings and varves. The most important cycle found by Mr. Gillette after thousands of hours of the

most laborious work on tables of frequency derived from the source material are those in the triple-progression series starting with seven. In other words, in this series the peak rainfall has been found to occur in years which are multiples or derivatives of seven—both larger and smaller—such as 21, 63, 189, 567 and 1701. This series is, of course, merely one of those which can be picked out in a study of tree rings and varves. But Mr. Gillette found it to be dominant in regard to rainfall. In so doing, however, he discovered other series so plainly marked that he had to take notice of them, too. And in this way he branched into the relative subjects of the effect of sunspots and even the frequency of earthquakes.

And now comes the most amazing development of all.

Mr. Gillette, having approached the matter from a purely scientific standpoint, was attempting all along to use his head in a common-sense way to determine the basic reason for the cycles if such there proved to be.

Now he remembered that Michael Faraday, the great physicist of the last century, had pointed out that oxygen is the "iron" of the air in regard to magnetic attraction. In other words, oxygen bears the same relation to a magnetic field as a nail does to a toy magnet. With that as a starting point, Mr. Gillette began working toward the idea of electronic influence from the sun as the basic cause for the harmonic vibrations to be observed in such common earthly phenomena as rainfall and earthquakes.

He knew also that it has been proved there is a cycle or tide even in the magnetic attraction affecting the ordinary compass and that there is the same harmonic change or "tide" in regard to the pressure on barometers. He discovered that these cycles tied in with the rain cycles to indicate a common basic cause—namely, electrons.

Indeed, he found in all the cycles—both short and long—of whatever nature a harmonic recurrence so that at some time they all coincided to form a perfect pattern as if nature had many throbbing hearts all forming a symphony when regarded as a whole.

It has been established for some 100 years—and every radio listener can testify to the latest in static—that there is a regular 11-year cycle in sunspots, the spots showing their greatest intensity at those intervals. Mr. Gillette's investigations, then, have led him to one major conclusion that the bombarding of the earth with electrons from the sun at regularly defined cyclic intervals is responsible for the well-known semi-annual storm conditions of March and September, commonly associated with the equinoxes, the well-established cyclic variations of sea level and the rain cycles which he had discovered and charted.

His idea, backed up by thousands of pages of proof, is simply this:

That the sun at regular intervals—some of them as short as a few minutes but the more important ones starting with the six-month cycle—sends out the extra volleys of electrons which are responsible for our weather conditions. For instance, on Mar. 8 and Sept. 8 the sun's axis is pointed directly toward the earth and it is at this time that the major magnetic disturbances of the year occur. The equinoctial dates Mr. Gillette regards as purely fortuitous in this connection.

It is Mr. Gillette's contention that the electrons, being attracted in greatest number to the earth's several centers of magnetic attraction such as the commonly accepted magnetic pole which guides compasses, act in effect like giant aerial magnets upon the oxygen in the earth's envelope of atmosphere and cause the cyclonic and counter-cyclonic upsets which we call storms.



When the  
going gets

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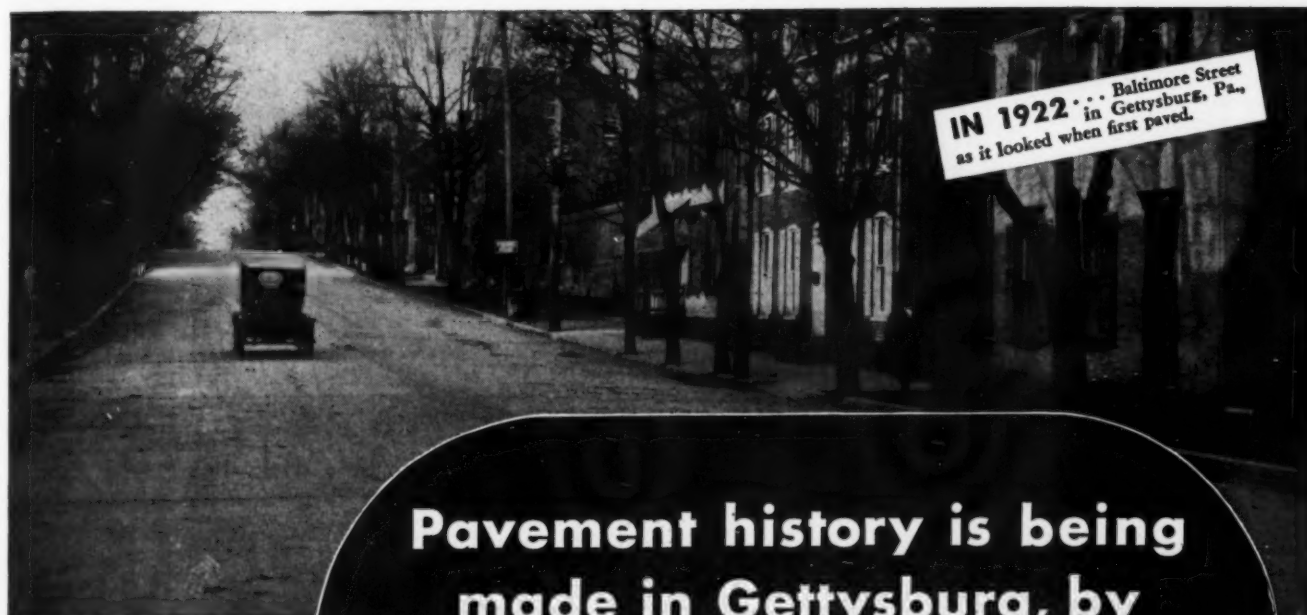
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*The More Concrete Streets the Less Maintenance Expense*



*Air Photograph Showing Southwesterly and Southern Areas of Lanai, Looking Eastward, with the Kaumalapau Road, Linking Pineapple Fields and Harbor, Shown in the Roberts Photo*

## THE PINEAPPLE HIGHWAY

By JOHN TERRY

*Hawaiian Pineapple Company, Ltd.*

**S**TARTING from the tiny harbor of Kaumalapau on the southwest shore of Lanai Island in the Hawaiian group, a 20 foot road winds upward for 3.64 miles to emerge 1,200 ft. above the sea, on a broad table land. From that location, the landward view explains the road. To the low, cloud shrouded ridge whose base lies five miles to the east, and in either direction to the southeast and northwest, the eye sees nothing but a grey-green carpet of pineapple plants.

Pineapple, and nothing but pineapple, explains every inch of the road which dynamite and picks have bitten into the lava bluff between table land and sea; incidental

to pineapple is every other function the road may serve aside from the movement of fruit from field to harbor.

From the day when the first fruit laden truck rolled down the 6 per cent grade to Kaumalapau, the road has borne the weight of hundreds of thousands of tons of Dole pineapple destined for the market—and the road, thanks to one resurfacing job, is sounder today than it was when first completed.

In various ways this road which pineapple and private industry have built is remarkable. Its single purpose distinguished itself at the outset. Its sea girt isolation presented problems of cost and construction. The pay load of its traffic moves only in one direction.

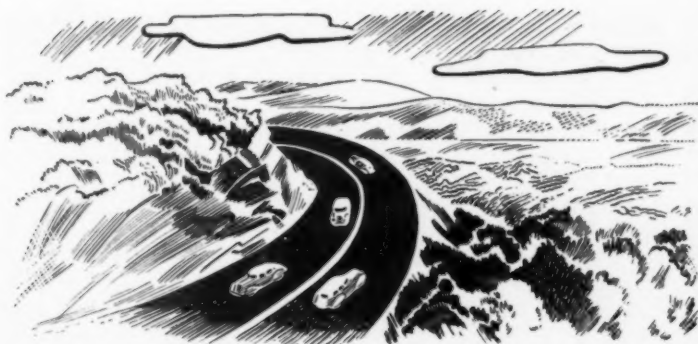
In 1922 the Hawaiian Pineapple Co. bought the island, an outright purchase except for several rights-of-way owned by the territory and for a few "kuleanas," or private holdings, whose occupation by native Hawaiians dates back before the day when Captain Cook, in 1778, raised the islands over the horizon on his voyage of discovery. The company found itself in possession of an island of 140 square miles, its soil eroded over extensive areas as a result of rain, wind and the grazing of cattle and wild goats and sheep, its rich table land choked with cactus and its surface scantily traversed by horse paths and a primitive wagon trail or two.

Less than two years later, with a harbor blasted out of the lava cliff, a model plantation community taking form and the first pineapple plantings rooted in the cleared earth, company engineers turned to the task of linking fields and harbor with a permanent, modern highway.



*Early Picture Showing the Road as Originally Constructed. Rock for Gutter Shown at Right Was Cut on the Site from Lava*

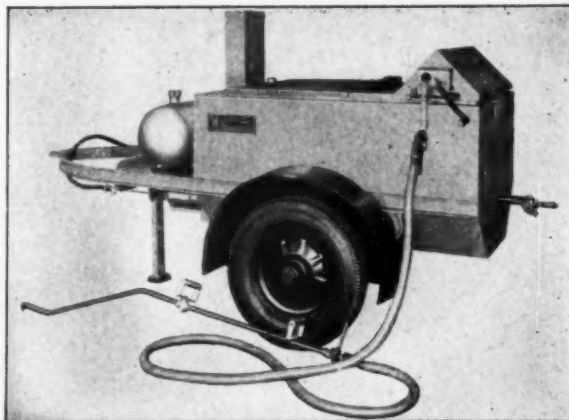




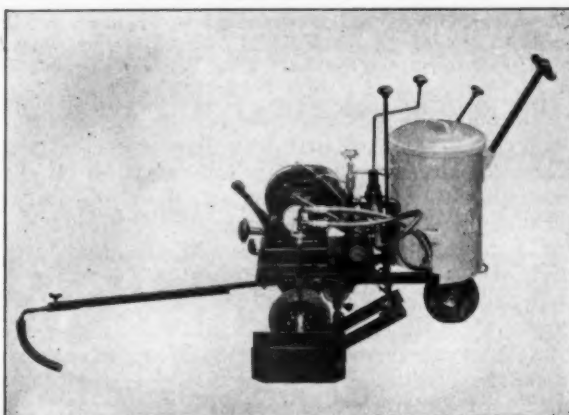
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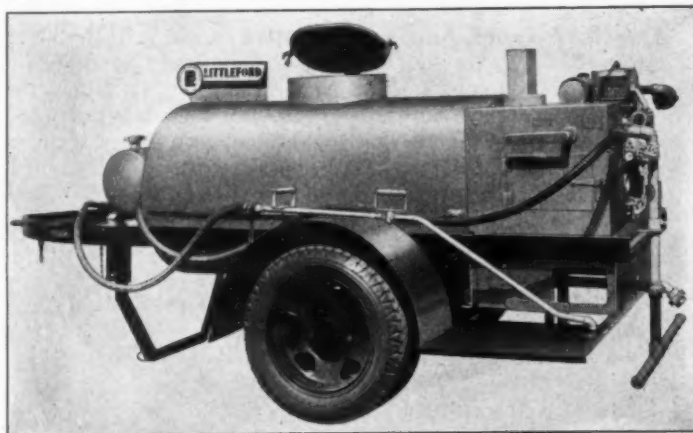
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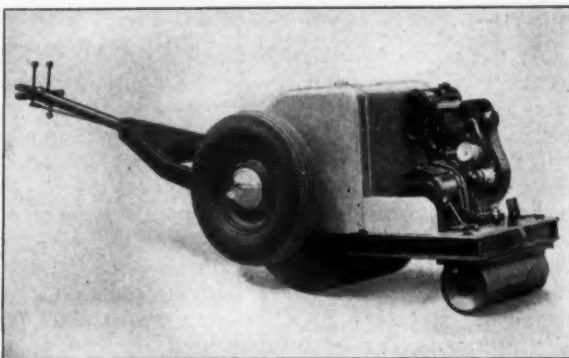
**84-HD Kettle**—This tar and asphalt kettle gives faster heating, continuous flow of materials. Made in sizes from 75 to 300 gals.



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## LITTLEFORD

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*The Kaumalapau Road Approaching the Harbor, Which Lies over the Shoulder of the Hill and Beyond the Fuel Tanks. Note Lava Outcroppings. This Rock Was Found Unsuitable for Sub Base Purposes*

Although the cliff rises sheer from the surf in a perpendicular, 1,083 ft. wall less than two miles south of Kaumalapau, and reaches a somewhat lower elevation immediately north of the harbor, the plans and specifications prepared by the company's engineers provided for a road cut into steep lava bluffs, yet skirting no precipices and requiring no tunnels.

In November, 1923, the contract for excavation and grading was let, and work began. When that task was completed, the company itself undertook construction of sub-base and surfacing. Some 300 days after the first charge of dynamite had blasted into the rock, the road was complete at a cost of approximately \$52,000 a mile for a 20 ft. surface.

Beneath the wheels of the big White truck and trailer units which carry 30-ton pay loads of harvested pineapple to Kaumalapau lies a 12 in. sub-base of graded rock, surfaced with a  $\frac{3}{4}$  in. coat of emulsified asphalt.

That is the road as it is today.

At the outset of construction it was found necessary to erect two rock crushers on the boulder strewn plateau above Kaumalapau harbor. Quarrying was useless, because the lava hillsides furnished rock too soft to withstand the punishment of heavy truck transportation. Importation of heavy road building equipment and lumber for construction of living quarters for workmen, all of which had to be ferried across channel waters by barge and steamer from other islands, presented costs high enough in themselves without the additional expense of importing rock in any considerable quantity. Requirements for a durable base were met by lava



*The Road to Kaumalapau Combines Scenic Beauty with Business*

boulders, broken up in Allis-Chalmers and Austin-Western jaw crushers.

A 3 in. layer of coarse rock, sprinkled and rolled formed the road's sub-grade. On that foundation was laid a layer of No. 2 rolled crushed rock, 6 to 8 in. deep. A coat of hot asphalt was then applied, followed by 1 to 2 in. of No. 3 rock, rolled in.

Stone gutters cut on the site from native lava were installed in places along the upper side of the road, and 2 x 6 in. screed boarding on the lower.

In time, water seeped through the surface, which had been left rough to provide better traction for truck wheels. Dampened by rain and pounded by the solid tires which were still standard truck equipment during the road's first years, the sub-grade softened, necessitating minor repairs within two years after completion of construction.

Late in 1934 the only major repair job the road has known was undertaken. The rotting screed board was removed, and concrete poured in the cavity. The road was covered with a  $\frac{3}{4}$  in. bitumuls armor coat, which effectively shut out water by sealing the surface. Meanwhile, pneumatic tires had replaced solid treads on trucks and trailers, thereby reducing road wear.

One insight into construction problems is furnished by the fact that all of the 15,885 cu. yd. of excavated rock came from only 20 per cent of the 19,270 ft. length of the road.

Other cubic yard measurements follow: dirt excavated: 24,800; embankment, or fill, 4,727; retaining wall, 1,900; guard wall, 389, or 1,400 linear ft.

Sixteen years have gone by since the road was completed. Aside from its armor coat, it remains unchanged. In Uncle Sam's Territory of Hawaii, where cliffs, volcanos and lava fields have presented unusual road building problems, the road to Kaumalapau, built by private industry, holds its own as an example of solid highway workmanship.

**New York Highway Engineers to Meet in Rochester**—The 5th annual convention of the New York State Association of Highway Engineers will be held March 28, 29 and 30 at the Hotel Seneca, Rochester, N. Y. Business sessions will open on the afternoon of March 28th, the morning being given over to registration and demonstration. At night will take place the annual banquet of the Association with business sessions continuing all day Friday and an entertainment at night. Saturday P.M. there will be trips to various points of interest around Rochester. Paul L. Ryan, P.O. Box 72, Rochester, N. Y. is a member of the executive committee.

**30,710,000 Motor Vehicles Registered in 1939**—Motor vehicle registrations in 1939 in the United States hit an all-time high of 30,710,000. This compares with 29,485,680 in 1938. Registrations of commercial vehicles in the United States rose to 4,460,000 in 1939 from 4,224,031 in 1938.

**Highways in Finland**—In 1937 there were 20,567 miles of roads in Finland, of which about 19,880 miles were of gravel without any special foundation.

**Majority of West Virginia Farms on Dirt Roads**—According to a survey completed Jan. 1, 1937, by the Highway Planning Division of the West Virginia Roads Commission there were 7,000 business establishments along rural highways; 2,500 industrial plants; 172,000 dwellings; 4,900 schools and 3,200 churches; Majority of 35,000 farms were on unsurfaced secondary roads.

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## Contributed Editorial

### ROAD SHOW IN REVIEW

By GLENWAY MAXON, JR.  
Mechanical Consultant

*Author's Note.—This article is written as one man's opinion of the Road Show. It is not intended as a criticism or praise of any particular manufacturer or set of manufacturers, except for those few who seem to think that the arts involved no longer lend themselves to improvement.*

THE 1940 Road Show has come and gone. Apparently from most of the exhibitors' points of view, it was a huge success. From a mechanical point of view, there probably were more innovations and more improvements on exhibit than at any previous show.

A number of manufacturers, however, showed practically the same equipment that they built for several years back, with minor changes only. These manufacturers vouchsafed the statement that their product was standardized and improved to a point where but little change can be expected in coming years. On the other hand, many manufacturers showed new tools or new models which differ considerably from their lines of a few years back.

Probably the greatest step forward has been in diesel engines. The contractor is beginning to lose fear of this kind of power as he gradually becomes educated in the matter of fuels, injection methods and starting devices. We may expect to see an ever widening use of diesel engines on contractors' equipment. As a matter of fact, this mode of operation and method of combustion has less intricacies than the carburetion of gasoline and its ignition in the cylinder.

Among excavators, a great deal has been done to improve appearance; speeds of operation still show a tendency toward increasing.

Locked-path roller wheels have eliminated much of the center pin trouble. Frames are showing more and more of a tendency toward welded structures instead of cast steel. The welding is far better and the choice of design is toward resiliency rather than mass.

Crawler frames are generally lighter in weight. More of these machines were shown this year with gears completely enclosed and running in oil. However, but little thought has been given toward making these machines more accessible, which may not be necessary if they continue to become more reliable. Future improvements of brakes and clutches may be expected, also simplification of controlling rods and levers.

While the appearance of the cabs and the general finish of parts is evident, many shovel booms and sticks are still awkward in appearance. The use of alloyed plates and shapes and welded boom constructions is becoming quite universal.

Concrete mixers and pavers apparently are changed only in minor detail, but considerable attention has been given to guards and appearances, and mixers are becoming a trifle lighter and are more compact. These machines have improved so much within the last five years that it is hard to believe they have arrived at a point of complete standardization.

Dirt-handling trucks are becoming larger and heavier with spring suspension frequently absent. These heavy-duty trucks are equipped with very large tires and have many characteristics of tractors. In fact, the gradation from truck to tractor was complete in all steps at the Show and the contractor is finding it terrifically difficult to choose the type best suitable for his present work and the type which will best fit such work as he hopes to get at some later date.

Slip scrapers of the glorified Fresno type are becoming larger and more complicated. There seems to be little uniformity in the general method of digging, hauling and spreading except for the length of cutting edge, which as might be expected, is pretty uniform for a given draw bar pull. The majority of these scrapers are crudely welded, although they show ingenious methods of using structural shapes, pipes and plates in the design of arches and other members subject to bending stresses. In the next few years, the advancement of this field will be great.

Several sheepfoot rollers were exhibited. These show some little change in design, such as replaceable feet, the use of alloys, and improved yokes and bearings. In this particular field, we may expect the advent of a number of devices for compacting which do not have the disadvantage of the hit and miss principle of the sheepfoot roller, nor the tendency to tear as well as compact. The justification for such machine may also be that the work it does will have better results.

Portable soil mixing apparatus is still in its infancy. As the art of stabilization advances, we may expect these machines to gradually increase in size and improve in appearance.

For the man interested in details, accessories at the Show took a great deal of time to cover even casually. There were any number of exhibits of engine accessories, also very interesting exhibits of bearings, clutches, lubricating systems, lubricating materials, chains, castings, gears, packing, oil-seals in addition to all the highway accessories as culverts, fences, drainage piping, weather-proofing, reinforcing. Even steel mills and cement manufacturers were well represented, together with the manufacturers or distributors of products of soil stabilization.

Most of the concerns showing accessories had some new features to offer and some new feature in their exhibit. Among these manufacturers of accessories appeared a great number which showed apparatus of oil-hydraulic machinery. In fact, the improvement in this type of equipment was more noticeable than in previous years. The truck manufacturers exhibited hydraulically operated dump trucks of every sort, from the very light 1½-ton jobs up to 20 tons or more. Although hydraulic dump truck practice is no new art, almost every manufacturer of hydraulic dump bodies had new things to show. Hydraulic equipment is making headway in graders, scrapers, concrete mixers, pavers, garbage collecting wagons, riveters, hydraulic motors and other apparatus. We may expect even more general use of hydraulically applied power if for no other reason than it permits the designing of frames to best provide for the stresses and the subsequent mounting on these frames of hydraulic parts where gear, shaft, clutch, and brake construction frequently limits the design of a frame and leaves that frame somewhat impaired for the stresses imposed.

Criticizing some of the hydraulic apparatus adversely would be to the effect that not sufficient thought has been given to hoses and piping layout. Probably we may expect, in the future, hydraulic pumps of greater volume, working at higher pressures and apparatus driven at greater speeds.

If the Show has done nothing more, it at least should be an indication to everyone that the art of building roads and the art of manufacturing machinery for building roads are still rapidly advancing, and probably will do so for some time to come. The contractor should be warned that he must be a student of machinery or must have someone in his organization capable of understanding the ever-growing intricacies of road building equipment.

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# EDITORIAL

## TELL YOUR STORY

**K**EEPING the public informed, we have often said, is a necessary and important function of the various road and street administrative agencies. Today the writer attended a luncheon of the City Club at Denver, Colorado, where Jack Furlong of the Colorado Highway Planning Survey explained what the highway survey is doing. He discussed the maps and their uses, and then took up their work on the source and destination studies in the Denver metropolitan area. The interest of this group, active Denver business men, was clearly exemplified by the fact that no one left the room even though the meeting lasted for one hour and forty-five minutes.

This type of information service is highly commendable. The more highway engineers tell their story and explain the work they are doing to the public the better cooperation will they get from the public.

## SNOW REMOVAL

**I**T may be interesting to note some of the costs entering into snow removal work in Wyoming, as given by the state highway department.

In size, cost, and work done, the equipment varies from the heavy rotary type used in the mountains to the small blade displacement plows. In snow removal work the equipment, to operate efficiently, must work in the varying depths of snow to which it is best suited.

The blade displacement plow shoves the snow to or off one side of the road. They are usually operated at high speed so that momentum will throw the snow clear of the road. The cost of operation for this type of equipment is made up of the depreciation cost on the equipment, the cost of repairs, and operating costs. The latter include gasoline, oil, wages, etc. For the smallest type, the cost amounts to \$4.20 per hour of operation.

The light V-type plow which also operates on a 1½ ton truck costs approximately the same as the side push blade plow, i.e., \$4.20 per hour of operation.

When the snow becomes heavier so that heavier equipment and more power for speed is required, larger blade plows are used. Four to five-ton trucks are required. The hourly cost for these is approximately \$6.00. If the large V-type plows are used on the heavier trucks, the hourly costs rises to approximately \$8.20.

Another type of plow which has been used to some extent is a combination of the blade and rotary which is, strictly speaking, a blade displacement plow, but has a small rotary fan attached to the outer end. It shoots the snow off from the end of the blade. It costs approximately the same to operate as the heavy V-type, i.e., about \$8.20 per hour.

The rotary plows are the heaviest type now used. It is used where snow fall is heaviest or where side push plows build high windows along the edges of the road. It is used mostly in mountainous areas, however, at times in the past, it has been shifted to prairie roads. This type is used only when absolutely necessary because the cost of its operation is approximately \$12.00 an hour.

On all of these units experienced operators are required.

## AMEND H. R. 6395

**W**HEN you are doing something or going somewhere and an obstruction appears ahead of you, what do you do? You either remove it or go around it. Right now an obstruction in the path of state highway administrators is being planned in Washington. It should be removed before it is enacted into law. It is your duty to help remove it.

Jurisdiction over wages paid by the state highway departments rests with the states. Of course, on federal aid work, where federal money enters into payment of the costs of construction, the Public Roads Administration approves the wages paid on contract work. For the sake of equity between laborers and, also, for uniformity, no variation between wage rates paid on federal aid projects and those paid on state projects is made. In their approval the Public Roads Administration is governed by the federal minimum wage law.

Now comes a new idea in the form of H. R. 6395 on which hearings are being held before the House Judiciary Committee of the Federal Congress. This bill provides that the Secretary of Labor shall determine and set the wages to be paid on projects partially financed with federal funds. Along with the Public Roads Administration it drags another federal agency into a supervisory, regulating—yes, even hindering—capacity. Certainly the check made by the Public Roads Administration should be sufficient control for the federal government to exercise their authority over the establishment of minimum wage rates. Enactment of the legislation will give the Secretary of Labor full control of the salary and wage rates paid by state highway departments, because practically all of the work which is done involves the expenditure, partially at least, of federal funds.

The danger of this proposed legislation lies not only in the fact that some of the Western states which are paying higher wages than Eastern states must face the danger of being required to lower them but more important is the fact that another Washington bureau will be authorized to tell the people of the several states how they shall conduct their business. Labor is now protected from Washington by the minimum wage law; they are protected by the Public Roads Administration; it is absurd to drag another agency into the picture. If this continues, pretty soon the federal and state highway construction programs will be hampered and cluttered by outside control as badly as the program of the Pennsylvania Turnpike Commission.

Highway and street federal aid should be exempted from this bill. Tell your Congressman and Senator so. The Public Roads Administration, a federal agency, is now doing a good job on this front. They should not be bothered by another federal agency. Write or wire to your federal legislators requesting them to use their influence to amend this legislation.

**Pennsylvania Turnpike**—Contractors who have done or are doing work on the Turnpike are supporting a movement to investigate Workmen's Compensation rates, believing these to be unduly high. We learn that operators having 16 contracts involving more than \$17,000,000 worth of work have already subscribed. Those desiring information are requested to write the Chicago Office of ROADS AND STREETS.





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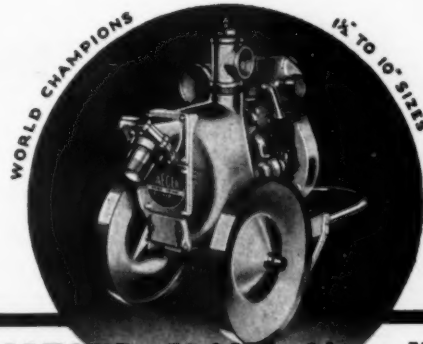


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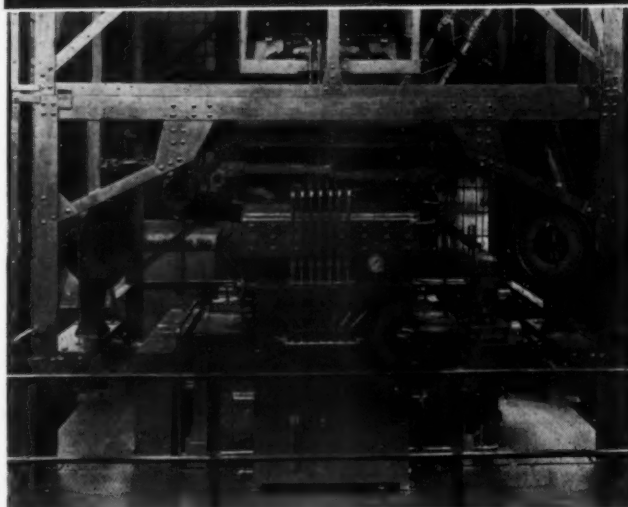
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# BRITISH ROAD RESEARCH

**T**HE Department of Scientific and Industrial Research of the British Government on Jan. 22 issued the annual report of the Road Research Board. The report, which was published by His Majesty's Stationary Office, London, describes the work of the Road Research Laboratory during the year ended Mar. 31, 1939. Extracts from the report follow.

During that period the laboratory site has been enlarged by 16 acres. This has made it possible, the report states, to proceed with the construction of a special skidding track 2,000 ft. long, by means of which it will be possible to obtain essential information on skidding under more favorable conditions than exist on normal roads. The track will also form a useful calibration surface for the various machines now used by the laboratory for studying the non-skid properties of road surfaces and for the sidecar machines employed by the Ministry of Transport in different parts of the country.

**Full-Scale Trials**—The Board direct attention to the which have accompanied or followed laboratory experiments. For example, laboratory tests on the use of acid to reduce the slipperiness of smooth concrete surfaces have been continued on a full scale, and it has been shown that the method is both practicable and cheap.

The treatment of ice-bound concrete surfaces with chemicals in such a manner as to thaw the ice without damaging the concrete is to be investigated in practice by methods which laboratory tests have shown to be the most suitable.

Durability tests on bituminous binders are being compared with the road performance of surface dressings and thin carpets containing these binders.

Full-scale trials are in progress on tar-rubber binders designed in the laboratory for surface dressing and for thin surfacings.

A series of carpets containing asphaltic binders has been laid on the Colnbrook By-Pass with a view to relating their physical properties with road behaviour.

The investigation of methods of designing bituminous mixtures on a basis of simple laboratory tests has been extended to the point at which it is felt that full-scale trials are justified, and preliminary arrangements for these trials have been made with the Ministry of Transport.

Work involving extensive practical trials is also proceeding in co-operation with the Timber Development Association with the aim of improving the skidding resistance of wood block surfacings.

Other laboratory researches leading to practical trials include an improved design of cast-iron surfacing, by which it has been possible to increase the sideways force coefficient from about 0.25 to 0.45.

The foregoing investigations which have led directly to full-scale trials are cited as an indication of the way in which the research work is now evolving from the purely laboratory stage into the realms of practical demonstration to the road engineer. It is anticipated that these developments will increase in volume and usefulness as the work proceeds.

**Soil Surveys**—Experience of soil surveys undertaken in co-operation with the Ministry of Transport prior to the construction of experimental roads has demon-

strated the value of the information that can be obtained from such examinations. The Ministry has accordingly decided to make increasing use of soil surveys in new trunk road construction and is having investigations made in all suitable cases. Already in the past year surveys have been made for seven new roads; and it is expected that the value of a survey, as a preliminary to construction, will become progressively greater as knowledge of subsoil conditions accumulates.

The examination of the settlement of embankments has been continued, but the movements have in general been measured for an insufficient period of time for conclusions to be drawn. Closely related to this investigation is the examination of the effect of compacting soils by mechanical means. This is a laboratory investigation in the first place, and it has been shown that mechanical compaction expels air but not moisture from the soils. This fact places a limit on the degree of compaction which can be achieved in practice, and is of importance in assessing the value of mechanical methods in compacting earth-works.

**Standard Test Sieves**—A study of the tolerances allowed in the apertures of standard test sieves for aggregates and their bearing on the testing of commercial products has shown that no advantage is gained by using more than a limited number of sieves in examining the grading of an aggregate; it has thus been possible to suggest a material simplification in testing technique, and this has been accepted by the British Standards Institution.

Methods of measuring aggregate shape devised at the Laboratory have also been adopted by the Institution. It has been found possible, in addition, to express the distribution of particle size in a "single-sized" aggregate in terms of two simple constants. This result has an important bearing on methods of specifying the grading of broken stone and chippings, since it makes it possible to specify for all sizes of stone the same limits of variation from the nominal size, and thus to ensure a constant degree of quality.

**Bituminous Road Mixtures**—The study of the design of bituminous road mixtures has led to the formulation of several principles related mainly to properties measured in the laboratory. In the course of the year preliminary arrangements were made for an extensive series of trials on the Colnbrook By-Pass designed to check these theories of proportioning. These trials will form an important step in development from laboratory research to practical application.

In co-operation with the British Road Tar Association an attempt is being made to relate the durability of tar under road conditions to the results of durability tests made in the laboratory. For this purpose tars made by a number of different processes, including the addition of small quantities of bitumen, have been supplied from works in various parts of the country.

The range of bitumens under examination in co-operation with the Asphalt Roads Association has been extended to include some abnormal materials; by studying the effect of these abnormalities, it is thought, light may be thrown on the factors which influence the behaviour of normal bitumens. The mechanical properties of mixtures are also being examined, and the work suggests that the essential properties defining the be-



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## OF 1940 Smash Hit ROAD SHOW

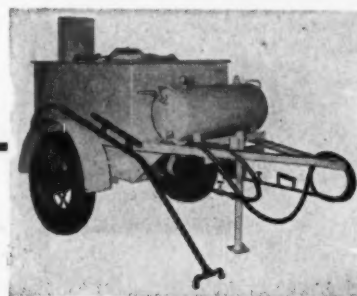
Crowning achievement of 42 years' manufacturing experience, the streamlined 1940 "Black Topper" proved to Road Show-goers that again Etnyre gives "MORE FOR YOUR MONEY"! Again buyers chorused, "It's still Etnyre"! And they backed their judgment with orders. To get the complete story on this sensational new "Black Topper," see your nearest Etnyre dealer or write direct. Ask for new, pictorial "FOTO-FACTS." E. D. Etnyre & Co., Oregon, Illinois, U. S. A.

- ★ Patented "Turn-Up" or "Shut-Off-At-Nozzle" Circulating Spray Bar—no drips, no skips, no leaks, no streaks!
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- ★ America's most compact circulating system—saves time, saves money!
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FIRE PROOF—OIL BURNING  
Hand and Motor driven spray.  
Many sizes. Write for catalog.

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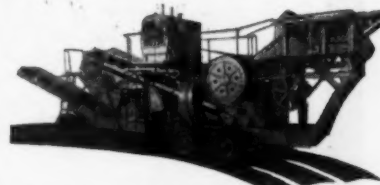
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haviour of a mixture are the rate of deformation under unit stress, the plastic flow index (which relates the rate of flow and the applied stress), the temperature coefficient of deformation, and the extensibility.

**Chlorinated Rubber Tar Mixtures**—It was noted in the last report that full-scale tests on chlorinated rubber tar mixtures had been arranged in collaboration with the British Rubber Producers' Research Association and the Ministry of Transport. These tests, as well as parallel laboratory investigations, have made it clear that a special tech-

nique will be required for handling such material. It is clear also that the method of preparing mixtures of chlorinated rubber and tar has a great influence on the properties of the product obtained. If the chlorinated rubber is first added to the tar, for example, and the mixture is then fluxed back to the required consistency the product is very much less elastic than that obtained when the chlorinated rubber is first incorporated in the flux and then mixed with the tar.

**Skidding Tests**—The apparatus for carrying out tests on skidding at

high speeds has been completed during the year and a few tests have been made at speeds up to 70 miles per hour. The results at present available indicate that the sideways force coefficient continues to decrease at the higher speeds. Information is also recorded in the present report showing that the influence of temperature on tire hardness and on the viscosity of the water film is important. It is hoped that the skidding track and now under construction will enable the small-scale skidding apparatus the missing information to be obtained under more favorable conditions than are possible on public roads. A further development which may throw some light on the problem of road safety is the statistical investigation which has been begun in collaboration with the Ministry of Transport and Scotland Yard with the object of relating road surface conditions (sideway force coefficient) with accident records for typical London streets.

The statistical investigation of traffic and weather of the Colnbrook By-Pass has been continued. It has been found that the most densely trafficked strips of the by-pass (the roadway of which is 30 ft. wide) occur about 9 ft. to 10 ft. from the curb, just inside the traffic lane marking, and that the traffic intensity at this point is nearly  $2\frac{1}{2}$  times the average intensity for the whole road.

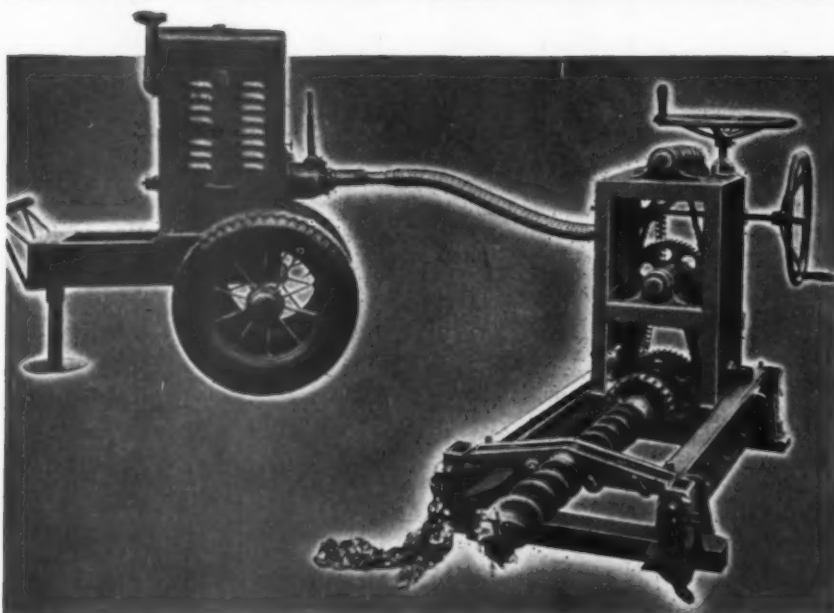
A start has been made on an investigation by means of a cathode ray oscillograph of the stresses caused in road materials by moving vehicles. Shear stresses, as well as vertical pressures have been recorded, and one interesting indication already obtained is that whereas the horizontal stress under a pneumatic tire is compressive in character that under a solid tire is tensile.

#### Stresses in Concrete Road Slabs

—The investigation of stresses in concrete road slabs due to static loading and other causes has led to the development of a method by which the stresses due to warping can be computed when, as is commonly the case, the temperature gradient through the depth of the slab is not a straight line. The other stress-producing factors have also been studied further, and experiments are now in hand which it is hoped will enable the stresses due to the several causes to be combined. Finally, developments in the use of machines for consolidating and finishing concrete roads have been further studied: a special report has been written which summarizes the results of experiments carried out on this subject.

## Parmanco

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#### Manager of a large Utility Company reports:

"As to my opinion of the drilling machine that you furnished on the gas distribution job at Houma, I would like to say that I think it is one of the biggest money saving and labor saving devices that has been put on the market in a good many years. I am basing my opinion on what I have seen and not heard."

★ *Parmanco more than saved its cost on pavement cuts eliminated on this initial job.*

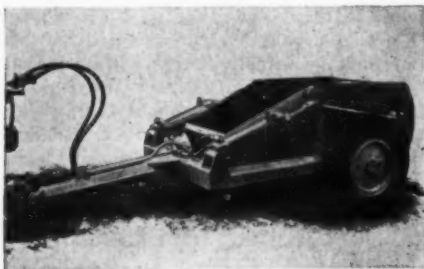
WRITE US YOUR DRILLING PROBLEMS

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PARIS, ILLINOIS

## NEW EQUIPMENT AND MATERIALS

### New Scraper

A new 2-wheel hydraulic scraper built for use with tractors rated at 25 to 35 H.P. has been announced by the Bucyrus-Erie Co., South Milwaukee, Wis. The scraper has a struck capacity of  $2\frac{1}{2}$  cu. yds. but will, according to the manufacturer, heap to loads of 3 or 4 cu. yds. The scraper, with its tractor can be loaded on a regular truck and hauled within usual dimension and load limits, so special permit is needed to haul it over the highways. It also can be used with a rubber-tired tractor. Similar in design and construction to the larger Bucyrus-Erie 2-wheel scrapers, the new scraper operates on a safe low-pressure hydraulic system. It has the exclusive Bucyrus-Erie "double curve" cutting edge, and it dumps backwards and behind its wheels like a dump truck. The



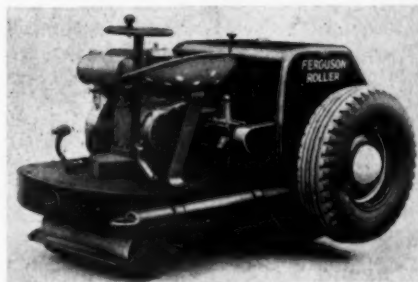
New H-28 Scraper

back-dumping feature makes it possible for the scraper to dump its loads over the edge of a bank or a fill; or over the edge of a ramp into trucks or cars. This feature also makes it possible to end-dump against foundation walls, bridge abutments, or around culverts. When dumping on the level, loads can be spilled in a heap, and the adjustable floating tailgate floats over the dumped load without dragging material away from the dump. If desired, loads can also be dumped in windrows and spread. Like all Bucyrus-Erie scrapers, the new scraper can be hauled by a tractor equipped with a Bucyrus-Erie bullgrader or bulldozer to make a combination unit. With the 2-wheel scrapers, hydraulic pressure for both units is furnished by a single pump on the tractor, and each unit is controlled by a separate valve conveniently located beside the operator.

### New Maintenance Roller

A new small roller has been brought out by Shovels Supply Co., 1300 McKinney Ave., Dallas, Tex. The large cast iron front roller, 32 in. in diameter and 24 in. face, is stated to provide a pressure of 152 lb. per inch of roll. It is controlled with worm and gear steering wheel acting directly on small front roller which is made in two halves to provide easy steering. Power is provided by 6 H. P. air cooled Wisconsin engine, driving through two speed transmission and floating plate clutch; final drive is through steel cut sprockets and roller chain to large roller, providing speeds of  $1\frac{1}{4}$  and  $2\frac{1}{2}$  miles per

hour. When roller is to be moved to or from job large pneumatic roller bearing wheels are lowered by means of self locking jack screws, actuated by convenient crank at front of machine. The trailing tongue, carried in loops on side of roller, is then inserted and roller is ready to trail behind light truck at 50 M.P.H. Two minutes are required to raise roller and make ready for travelling or, when job is reached, to reverse process and make roller ready to work. Since the operator rides and steers roller he is completely removed from danger of passing traffic and



Ferguson Maintenance Roller



## SILVER KING

### HIGHWAY MOWER

When this efficient mower comes down the road it leaves a smooth, even path in its track. No re-cutting. The first time over lasts longer because of the close cutting job it does. If you're responsible for purchasing highway mower equipment, by all means send for the free folder illustrated below. You owe it to yourself to see what a truly great mower the Silver King is.



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has perfect vision of work to be done. Due to special features of steering mechanism roller can readily be maneuvered in close quarters or turned in small radius. Both rollers are provided with self adjusting scrapers and cocoa mats which are kept wet from large tank in hood of roller, thus preventing material sticking to rolls.

### New Motor Graders

Two new motor graders of the "engine over drive" type have been announced by J. D. Adams Co., Indianapolis, Ind. Both machines are identical in design. The larger, known as the No. 411, is powered by 62½ H.P. Diesel engine and is a low-

price, heavy-duty machine. The smaller, No. 303, is in the popular price class and is powered by 45 H. P. gasoline engine. These new graders are built around the all-welded, box-type main frame originated by Adams several years ago and which now characterizes all Adams motor graders and leaning wheel graders. The outstanding advantages of this type of frame, it is claimed, are its strength and rigidity, the unhampered visibility of the blade it affords the operator, and the extremely wide range of blade positions which it permits. Operating advantages claimed by the manufacturer are: With same setting of the lift linkage, and with blade in center position, the blade can be adjusted from deep ditching position to high bank



New Adams No. 411 Motor Grader on Construction Work

cutting position in about 40 seconds permitting all adjustments on 90 per cent of work to be made without the operator leaving the cab. Blade can be set vertically if desired and very wide shoulder reach or flat-bottom ditching positions can be obtained. Circle is full revolving and blade can be set to ditch or move dirt with machine operating in reverse gear. Blade can be reversed with scarifier on machine by simply lifting scarifier teeth out. Both machines have eight forward speeds (with high top speeds for traveling), and two reverse speeds. Balanced weight distribution permits surface maintenance at 6 to 7 m.p.h. without objectionable bouncing or vibration. It is stated the wide range of blade adjustments in all directions, tandem drive with low pressure tires and leaning front wheels permit these graders to be utilized on all types of surface, ditch and bank work.

### New Excavator

A new excavator, Type 10, ¾ and ½-yd., has been brought out by The Osgood Co., Marion, O. The Type 10 is convertible in the field. The deck for the machinery is a sturdy, one-piece steel casting. All the machinery is mounted on machined pads. Engine and countershaft are mounted on cast iron safety fuel tank. Power is transmitted to the countershaft through silent chain drive, straight to the dipper, through gears running in oil baths. Swing and travel, crowd and retract gears are fully enclosed, and run in oil. They are equipped with multiple disc type clutches. The drum shaft is driven from the countershaft. Drums have removable lagging. Clutches are set by Osgood "Servo Mechanism", for swift, smooth and quiet operation. Drum shaft is anti-friction bearing mounted. The heavy



Osgood Type 10 Excavator



**Heltzel Superior Heavy-Duty Road Forms have established a new low cost . . .**

1. By building more miles of concrete slab.
2. By elimination of expensive upkeep and repairs.

**. . . and because Heltzel forms are easier to set and strip — form setting costs are reduced to a minimum. Write for complete information and descriptive literature. Catalog S-19.**

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BINS, Portable and Stationary  
CEMENT BINS, Portable and Stationary  
CENTRAL MIXING PLANTS  
BATCHERS (for batch trucks or truck mixers with automatic dial or beam scale)  
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FINISHING TOOLS FOR CONCRETE ROADS

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duty crawler construction is of unit steel castings in side frames and base, supported by strong cross members. Tread belts and chains are independently and separately adjusted. Ground clearance is exceptionally high. Cross travel shaft clutches are positive internal-external gear type, and steering brakes are contracting band type. All controlled from operator's position in the cab. The boom on the Type 10 is all steel, reinforced and welded into a strong unit. All unnecessary weight has been eliminated. Crowding chain runs up center of boom, self adjusting to all boom angles, and kept at right tension by simple chain tightener. Easy and quick to adjust. Manganese steel racking is welded to a strong steel shell to form the dipper handle. Vacuum dipper trip is used, giving easy, efficient operation. It is mounted on the deck, out of the way. Big boom point sheaves give extra wear to wire rope. The cab is the latest in streamlined development. It gives full operating vision, and the machinery the greatest protection, yet every part is accessible for adjustment and care.

#### New Diesel Electric Sets

To answer a continuing demand for larger self-contained "Caterpillar" diesel electric sets, Caterpillar Tractor Co., Peoria, Ill., has added a 66-kilowatt and a 52-kilowatt unit to its line. The two new sets, the 11-52 and the 13-66, are completely self contained, and require no gadgets other than a circuit breaker. Both are powered by 6-cylinder, heavy-duty diesel engines; and both require a minimum of maintenance and adjustments. As with the smaller sets, they can be set up and running within an hour after delivery. There are now five models of these units available in 15, 20, 30, 52 and 66 kilowatt capacities.

#### New Heating Furnace for Rock Drill Bit

The new "Jackfurnace" for the rapid heating of their detachable rock drill bit has been announced by the Ingersoll-Rand Co., 11 Broadway, New York. Designed especially for the servicing of jackbits, it can be used with either jackmills (hot-mills) or grinders. It can also be used for heating shanks and rod ends for hardening. Low pressure air from an induction blower passes through a pre-heating cham-

ber before entering the burner, thereby aiding combustion and increasing efficiency. Convenient controls enable the operator to attain the proper mixture of oil and air. The furnace can be equipped with an automatic temperature control device. It is stated that when heating jackbits for re-hardening, the furnace will handle approximately 180 jackbits per hour. It is well insulated to insure low room temperature for the operator. The manufacturer furnishes, as standard equipment, a loading spoon and an unloading device to facilitate the handling of jackbits to and from the furnace.

#### New Sickle Bar

Highway border mowing perhaps pre-

sents the most severe test of a tractor and sickle bar. A sickle bar arrangement developed for this service as well as for other types of mowing has been brought out by the Worthington Mower Co., Stroudsburg, Penn. It is stated that the new reciprocating differential drive mechanism (patent pending) located on the inner shoe, would permit the operation of the sickle bar through a full 360 degrees angle if it were not for the tractor chassis being in the way and limiting its range. As it is it has a range of cut from 100 degrees above to 9.0 degrees below horizontal. This entire driving mechanism is enclosed in grease and dust proof housings and runs in a bath of oil. It is a direct

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● Yes, Marmon-Herringtons are "naturals" for the most difficult jobs on the face of the earth—but the same *exclusive* features of design and construction which enable them to perform such amazing feats on steep hills, in mud, sand or snow, make Marmon-Herrington *All-Wheel-Drive* Fords and Heavy Duty vehicles the *safest, most economical to operate on paved roads and streets*. Positive and easy control of steering, and almost entire elimination of wheel slippage cut fuel and tire costs to the bone, and provide unusual freedom from skidding. Let us show you how you can make or save more money, or both, with Marmon-Herrington *All-Wheel-Drive*.

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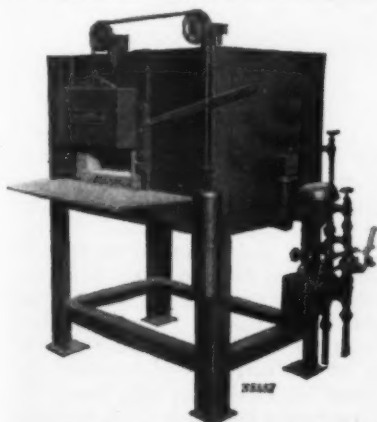
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Ingersoll-Rand "Jackfurnace" Equipped  
with Automatic Temperature Control



*The 1940 Worthington Tractor and Sickle Bar in Operation*

drive from the Pitman fly wheel through a Pitman rod and the knife action is continuous for the full stroke of the Pitman rod at any degree, and the power take off does not have to be disengaged to allow the bar to swing back when an unseen obstruction is encountered by the bar. The new sickle bar is now available with the conventional hand-life aided by a powerful balance spring located within easy reach of the driver's seat, or a power hydraulic lift which is optional at slightly higher cost.

#### **New 1-Yd. Shovel**

A new 1-yd. full-revolving crawler-mounted shovel, the Model 41, has been announced by the Northwest Engineering Co., 28 East Jackson Blvd., Chicago, Ill. This shovel incorporates certain new principles of design and construction, but, ac-

cording to the manufacturer, still embodies basic features developed by Northwest over many years' experience in building this class of equipment. The upper and lower bases of this new shovel are special heat treated alloy steel castings—all high speed shafts are mounted on ball or roller bearings—practically all gears are enclosed and run in a bath of oil—uniform pressure clutches of the cone type are employed for swing, travel and boom hoist—the boom hoist mechanism is of the worm gear safety type—steering is by the differential method, giving positive traction whether the shovel is traveling straight ahead or turning—"Feather-touch" booster



*New Northwest Model 41 Shovel*

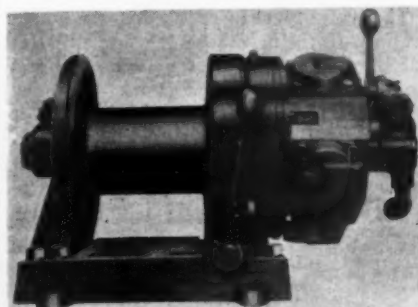
clutches are employed on the main drum clutches. The shovel boom, is of the split type with a single square stick of unusually large cross-section—the dipper is of 1-yd. capacity and has a cast Manganese front. The crowding mechanism is the Northwest patented "Dual Crowd" incorporating both an independent and automatic crowd. The machine is convertible from a shovel to a crane, dragline or pull-shovel and can be shipped on one flat car completely erected.

#### **New Steel Measuring Tape**

A new line of steel measuring tapes put on the market by The Lufkin Rule Co., Saginaw, Mich., are chrome plated, with jet black markings and satin chrome-white surface, unusually free of glare. Hence, the permanent markings stand out in sharp contrast, showing up well even in poor or artificial light. Furthermore, being built up by chrome plating, these tapes are extra strong, and resist rust. The surface is smooth, hard and easy to clean, and the tape, being of metal throughout, will not crack, chip or peel. New cases and frames of improved design and appearance have been built for this new line. "Anchor" is the chrome face tape in genuine leather case. It is offered in two widths,  $\frac{3}{8}$  and  $\frac{1}{2}$ -in., and in two graduations, feet, inches and 8ths, and, for engineers' use, feet, 10ths and 100ths feet. Chrome Face Tapes are offered also in  $\frac{3}{8}$  and  $\frac{1}{2}$ -in. widths on metal frames with plumb bobs for tank gauging in the oil industry.

#### **New Air Hoists**

A new line of single and double drum air hoists, powered by a 5-cylinder radial air motor, has been announced by the Gardner-Denver Co., Quincy, Ill. Important features claimed for these hoists are: Smaller overall dimensions and less weight per horsepower delivered; safety design



*New Gardner-Denver Air Hoist*

which makes it impossible to drop a load accidentally; powerful brake bands with conveniently located operating lever; hardened gears accurately cut and running in oil; entirely sealed gear train that absolutely prevents dirt and water from reaching any gears or bearings; sealed-in oiling system that insures proper lubrication without the need for constant watchfulness on the part of the operator; simple 3 points of lubrication take scare of all moving parts; throttle lever is self-centering with automatic safety ledge to hold it in neutral position.



This compact Universal "880" Portable Gravel Plant is one of over 50 types of plants for crushing, screening and loading gravel; and it is only one of the thousands of Universal profit-proved Crushers, Pulverizers and Stationary and Portable Plants that are producing materials at the lowest cost per yard, year after year.

*Get the facts—write for new catalog and user reports!*

**Pennies Saved  
Every Foot—  
from grizzly to truck!**



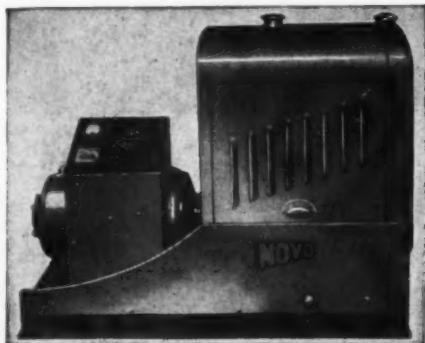
**Universal Crusher Company**  
631 C Ave. West  
Cedar Rapids Iowa

**UNIVERSAL**



### New Generating Set

A new line of generating sets has been announced by the Novo Engine Co., Lansing. There are fifteen different sizes built in DC and AC sets, powered with air- and water-cooled gasoline engines or Diesel power units. Features of these sets are their close-coupled design, portability, and their switch panel which has no open switches or fuses to burn out. These units were built to meet the demand for light for emergency work and also for power for the myriad of electric portable tools



*New Novo Generator*

now being used on construction jobs. They are stated to afford an economical source of light and power when and where it is wanted.

### New Compressor Unit

The accompanying illustration shows the Model 105 Fordair unit of Schramm, Inc., West Chester, Pa., mounted on a standard truck. Governor controls, power take-off controls, and compressor mounting have all been improved. The compressor unit is an 8-cylinder "V" block with special cylinder

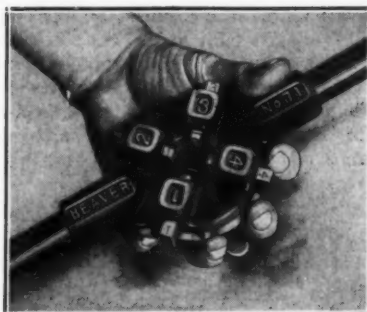


*Schramm Fordair Power Take-Off Compressor*

heads, camshaft, and manifolds. Although this unit makes an ideal combination with a Ford truck, it will operate on any standard truck that can be provided with a split shaft power take-off. Schramm also build a compressor designed for other sizes and for other truck dealers and manufacturers.

### New Pipe and Bolt Threader

A new pipe and bolt threader, for which more than 100 different kinds and sizes of dies are available, has been added to the line of Beaver Pipe Tools, Inc., 310 Hamilton Ave., Warren, O. It threads pipe from  $\frac{1}{8}$  to  $\frac{3}{4}$  in. right or left hand, and bolts from  $\frac{1}{4}$  to 1 in. right or left hand, coarse or fine thread. The die bosses project far above the face of the tool body so that



*Beaver "71" Threader*

chips clear instantly and even the long curls from soft-steel bolt stock cannot clog or jam the tool. The dies are easily oiled, and can be changed in 20 seconds, no tools being required. The dies are adjustable for oversize or undersize threads, and they adjust as a single unit, insuring uniform cutting.

### New Self-Priming Pumps

A complete new line of self priming pumps has been announced by the Sterling Machinery Co., 411 Southwest Blvd., Kansas City, Mo. No special flanges are used on any of the new Sterling pumps, all flanges being standard pipe flanges. Pump cases are very large to contain a large amount of priming water. By proper proportioning of the impellers and volutes and by positive control of recirculation unusually high efficiencies are attained. A

feature of these pumps is the placing of the cleanout plates so that the cleanout plates can be removed and access to both the eye of the impeller and the bottom of the priming water chamber can be secured without removing the suction hose. The angle suction connections with which all of these new pumps are equipped prevent kinking of suction hose and effect a considerable saving in cost of suction hose. Angle suction connections are standard on all of the new pumps but straight suction connections can be furnished at reduced price.

## WITH THE MANUFACTURERS

**Charles E. Wilson of Worthington  
Now Located at Home Office**

Charles E. Wilson, Vice-President since 1934, in charge of the Pacific Coast operations of the Worthington Pump and Machinery Corporation, has moved his headquarters to the home office of the corporation at Harrison, N. J., where he will direct the sales of all products handled by the Corporation's Carbondale Division, which specializes in air conditioning and refrigeration equipment. In this work Mr. Wilson succeeds H. A. Feldbush who henceforth will devote his time to the manufacturing department of the corporation. Mr. Wilson is also assuming direc-



PROCESSES TO MEET ALL TYPES OF ASPHALT PAVING

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*A Laboratory Controlled Pavement*

*Proven* BY THE  
TEST OF TIME

Our chemists check each run of Colprovia asphalt in the refinery as well as each new aggregate proposed for use.

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The high quality of Colprovia mixtures is determined before manufacture.

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## WILLIAMS LEADS IN WELDED BUCKET CONSTRUCTION



Williams Buckets have always featured more welding in bucket construction than any other manufacturer.

### NOW, IN THE NEW 1940 LINE OF WILLIAMS BUCKETS,

welded rolled steel construction is utilized in every feasible part. Sections which take the hardest blows or endure the greatest wear are built up by welding in special alloy steels.

**STRONGER! LESS BREAKAGE!  
LESS WEAR!**

Williams Buckets and parts are carried in stock for prompt deliveries and service by distributors in all parts of the country.

THE WELLMAN ENGINEERING CO.  
7003 CENTRAL AVE., CLEVELAND, OHIO

**WILLIAMS**  
*Buckets*  
built by WELLMAN

tional charge of the sales of all corporation's products built at the Holyoke, Mass. factory, consisting of small stationary compressors, rock drills, contractor tools and turbine well pumps. Mr. Wilson has been connected with the Worthington Pump and Machinery Corporation for many years in many capacities.

### Claude C. Hill of Kinney Mfg. Co. Dies

Claude C. Hill, associated with the Kinney Manufacturing Company of Boston, Mass. for over 30 years, died in Boston, Mass., Feb. 16, following an operation. Mr. Hill was born in Waterbury, Vt., 56 years ago. After early experience in a machine shop in Barre, Vt., he came to Boston as a machinist, in 1909, and progressed to foreman, demonstrator and outside erection supervisor. In 1930, he transferred to the sales department and was widely known especially among the users of bituminous distributors, in which field he was a recognized authority.

### E. D. Herrick Named President of Linn

The Linn Manufacturing Corporation, Morris, N. Y., manufacturers of Linn Tractors, has announced the election of E. D. Herrick as President. Mr. Herrick has had wide experience in the automotive industry for the past 20 years—most of that time being spent at the Lycoming Manufacturing Co., Williamsport, Pa., in the capacities of chief engineer, assistant general manager and president.

### Hercules Appoints Edward Ehrbar, Inc.

The Hercules Co. of Marion, O., has appointed Edward Ehrbar, Inc., 29-33 Meserole St., Brooklyn, N. Y., as distributor of Hercules rollers and iron rollers. They will serve the territory of upper New Jersey, Metropolitan New York, and lower New York state from their offices at Brooklyn, and their branch offices at Newark, N. J., and White Plains, N. Y.

### New Laboratory and Research Building for Cummins

A new ultra modern laboratory and research building is rapidly being finished for Cummins Engine Co., Columbus, Ind., builders of automotive, marine and industrial full diesel engines. The finished building now under construction by the Austin Co., Indianapolis, will be one of the most modern rigid frame "whale back" types built today. This new structure will house five departments: Metallurgical; Chemical; Engineering, Record and Supervision; Machine and Assembly; Engine Testing and Development. Dimensions are 80 ft. x 132 ft. which give 10,600 sq. ft. of floor space. The building itself will represent an estimated investment of over \$75,000. The sum of \$125,000 will be spent for the finest machinery for testing and building engines and parts available. Construction of this building follows closely upon the recent completion of a \$400,000 ultra modern, daylight factory unit, in which the exclusive Cummins Diesel fuel pumps and injectors are now built.

## Your Maintenance Dollar Will Do More



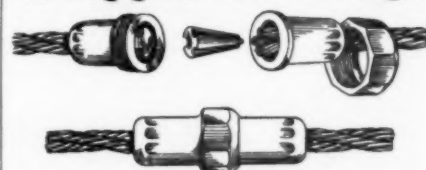
A BURCH UNDER-TRUCK-ROAD MAINTAINER mounted on a truck you now own, will put your rough, "pitted" roads in first class condition at a saving in cost of 40 to 50 percent over all former methods of maintenance.

Ideal for honing blacktop or stabilized roads. Can be attached to, or detached from truck in five minutes. Is hand hydraulic controlled from truck cab or, from the rear of the machine.

Write for Catalog

Manufactured by  
**THE BURCH CORPORATION**  
Crestline, Ohio

## Guard Cable Splice of Approved Design



This Wedge Type Union Cable Splice for standard 3-strand, 7-wire  $\frac{3}{4}$ " guard cable is the simplest, most easily installed and most economical cable splice we know about that will meet specifications requiring safety factor over cable of 25,000 lbs. rating.

Now used regularly in seven States and acceptable in others. Should be standard with any State now using the  $\frac{3}{4}$ " guard cable construction—both for maintenance and for new construction.

Sample will be sent free for field test by responsible Highway Official or Contractor; or trial order of any quantity at 66c each, F.O.B. Branford. Lower prices in quantity and through distributors.

Send for Data Sheet No. H-1

Other M.I.F. Specialties include: Cable Offset Fittings, Compensating Spring Anchors, Wedge Type Cable End Sets, Offset Pipe Railings, etc.



**MALLEABLE IRON FITTINGS CO.**  
Pole Hardware Dept.  
Branford, Conn.

### The Whytes Celebrate Their 50th Anniversary

Mr. George S. Whyte, familiarly known to his many business friends as Sandy MacWhyte, and his "guid" wife, on Feb. 10 celebrated their Golden Wedding Anniversary in a most unusual and delightful manner.

Mrs. Whyte, as beloved by all employees of Macwhyte Co., Kenosha, Wis., as her "partner," Sandy, invited all company employees and their wives to a strictly informal dinner.

There were no bands playing, no waving of flags, no pressure groups—all arrangements were handled and the complete dinner arranged by Mrs. George S. Whyte, Sandy's "guid" wife.

She extended personal invitations, ar-



Mr. and Mrs. George S. Whyte and Their Clock

ranged an excellent program in which employees took active part, and over 650 pairs of feet gathered together at the festive board.

It is truthfully said that this festive occasion celebrated not only fifty years of a happy married life but years of helpful cooperation together to build a company of the better kind with fair and impartial consideration for all.

When Sandy, "The Grand Old Man," passed his three score and ten mark three years ago, the employees—it was their own idea—presented him with a bronze plaque on which was engraved all their facsimile signatures.

On the occasion of their Golden Wedding Anniversary, the employees again showed their love and appreciation by presenting to Mr. and Mrs. George S. Whyte a handsome Grandfather's Clock on which was an engraved gold plate reading:

"Presented to Mr. and Mrs. George S. Whyte on their Golden Wedding Anniversary by the Macwhyte employees February 15, 1940."

Mr. Whyte, now Chairman of the Board of Macwhyte Company, is very active in the affairs of the company. His pleasing personality and homely philosophy have

kept him endeared to the hearts of his many friends from the days he labored in the coal mines of Scotland at \$1.00 a day through all the intervening years.

Of course there has always been harmony—employees are friends in this company.

### H. A. Feldbush Elected Vice President of Worthington

The election of H. A. Feldbush as a Vice-President of the Worthington Pump and Machinery Corporation has been announced by H. C. Beaver, President. Effective immediately Feldbush will make his headquarters at Holyoke, Mass., where he will have charge of operations of the corporation's Holyoke Works in the manufacture of air and refrigerating equipment. Feldbush was formerly general manager of the Carbondale Division of Worthington at its Harrison, New Jersey, Works, and in his new capacity will continue as an active member of the Carbondale Operating Committee. After his graduation from Westminster College at Fulton, Missouri, Feldbush received his B.S. degree in Mechanical Engineering from Washington University at St. Louis in 1915, the same year joining Worthington. He was promoted to junior first engineer in 1916 and transferred to the corporation's Cincinnati, O., plant, four years later being made engineer of tests; subsequently advancing to the position of general superintendent in 1923 and works manager in 1925. In 1933 the products and personnel of the Cincinnati Works were consolidated with the corporation's Buffalo Works. Feldbush was instrumental in effecting the purchase of the Carbondale Machine Company by Worthington and the subsequent development of the corporation's present line of Carbondale refrigerating equipment including Freon-12 compressors, condensers and evaporators and more recently the development of Worthington's larger centrifugal compressors for Freon-11.

### Brooks Equipment & Mfg. Co. To Sell Hercules Rollers

The Brooks Equipment and Mfg. Co., 408-10 Davenport Road, Knoxville, Tenn., has been appointed distributor for the Hercules Co., Marion, O. They are in a position to supply Hercules rollers and ironerolls in the eastern part of Tennessee.

### New Plant for Shim Company

The Laminated Shim Co., Inc., Long Island City, N. Y., manufacturers of Laminum shims, shim stock and small stampings, has construction under way on a new plant located at Stamford, Conn. The new building is to be a modern, 1-story manufacturing building of about 30,000 sq. ft. of floor space. Provision is being made in the structure for new general offices. It is expected that the plant will be completed early in June of this year. The company officials say that their need for larger manufacturing space is acute, and that they need it all on one floor. They also point out that due to the type of service business in which they are engaged, they be as near as possible to their sources of raw materials.

## Specify MONOTUBES

### FOR HIGH-LOAD PILES!

For maximum economy in your foundation design you can now allow higher loads on piling, if you specify Monotubes. This recommendation is based on fact—not theory. And to prove our point, we list below a few recent Monotube Pile installations for high design loads—

- |                |   |
|----------------|---|
| <b>85 TONS</b> | <b>PER PILE</b><br>Rock Island R. R.<br>Bridge Trestle<br>Bents, Metz, Iowa |
| <b>62 TONS</b> | <b>PER PILE</b><br>Grade<br>Separation,<br>Winnetka, Ill.                   |
| <b>50 TONS</b> | <b>PER PILE</b><br>Water Tank<br>Foundation,<br>Town of Lake, Wis.          |
| <b>50 TONS</b> | <b>PER PILE</b><br>Viaduct<br>Foundation,<br>Chicago, Ill.                  |
| <b>50 TONS</b> | <b>PER PILE</b><br>Oil Storage Tank<br>Foundation,<br>Bayonne, N. J.        |
| <b>40 TONS</b> | <b>PER PILE</b><br>Municipal Light<br>Plant Foundation,<br>Cleveland, Ohio  |

Monotubes of varying gauges of steel and of unlimited combination of assembly are available to drive and develop economically the maximum safe load values of deep soil strata.

To date, these sturdy steel casings have been driven in lengths of over 130 ft. and tested to 200 ton loads.

Write for copy of Catalog No. 68A.

**THE UNION METAL MANUFACTURING CO.**  
CANTON, OHIO







#### **BITUMINOUS DISTRIBUTORS**

are purchased for their usefulness. The working parts must be "get-at-able" so they can be lubricated and the pump kept packed—or breakdowns and delays will spoil your profits. Proper weight balance must be maintained—or rear tires will wear out too fast. Kinney Distributors are designed for accurate application—for simplicity in operation and control—for the safety of the operators—and for many years of continuous service.

Write Kinney Mfg. Co., 3537 Washington St., Boston, Mass., for a copy of Bulletin A-1940—it tells the whole story.



## **CORNETT SLOPER**

**Bank Sloping Revolutionized!**

**S  
P  
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D**



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Y**

- Slopes banks rapidly.
  - Easily attached to any shovel in an hour's time.
  - Will cut any slope that a shovel can dig through.
  - Controlled entirely from operator's seat.
  - Will cut through sand, gravel, soil, clay and broken rock in one operation.
- See your dealer or write for further details

**CORNETT SLOPER**

607 DeGraw St.

Brooklyn, N. Y.

#### **Appointed District Sales Manager for Williams Buckets**

The Williams Bucket Division of The Wellman Engineering Co., Cleveland, O., has announced the appointment of John E. Carlson and A. Winkler Prins as district sales managers for Williams buckets. Mr. Prins will be located in New York with offices at 30 Church St. He was formerly



J. E. Carlson



A. W. Prins

with the sales department of Hubbard & Floyd, New York, distributors of contractors' equipment. He has a wide acquaintance with bucket users in that territory. Mr. Carlson will maintain offices in the Equipment Division of Great Lakes Supply Corporation at 324 West 36th St., Chicago, distributors in the Chicago area of Williams clam shell and drag line buckets. Mr. Carlson for many years was with W. J. Newman Co., working on construction jobs in and around Chicago, and his practical field experience will be helpful to contractors and industrial companies in excavating and material-handling problems.

#### **Moore Steam Turbine Corporation Becomes a Division of Worthington**

The Worthington Pump and Machinery Corporation has announced that it subsidiary, the Moore Steam Turbine Corporation, of Wellsville, N. Y., is now conducted as the Moore Steam Turbine Division of the corporation. This became effective Jan. 2, 1940. The Moore Steam Turbine Corporation was a wholly owned subsidiary of the Worthington Pump and Machinery Corporation for three years, during which the corporation's nation wide sales organization with its service facilities has increased the volume of steam turbine sales to a point where it has been necessary for the corporation to provide additional plant capacity. A new manufacturing building and new equipment are about ready for use. The larger field of operations made possible by affiliation with Worthington has materially added to the number of employees at the Wellsville plant and increased the value of the industry to the community.

#### **J. C. Merwin Elected Treasurer of Chain Belt**

Chain Best Co., Milwaukee, Wis., has announced the election of J. C. Merwin to the office of treasurer in addition to that of vice president, which he now holds, and the appointment of L. B. McKnight as assistant to the vice president. Mr. Merwin, who is also a director of the company joined the organization in 1917. He has been a director since 1923 and in 1924 was elected vice president in charge of the con-

## **HERCULES**



### **DEPENDABLE ROAD ROLLERS**

**The Two-in-One Roller with Interchangeable Hydraulic 'Ironeroll' and Scarifier.**

**6 to 12 Ton  
Gas or Diesel**

**THE  
HERCULES  
COMPANY  
MARION-OHIO**

## **CUMMER** ...the dependable line of asphalt paving machinery

- ♦ Portable Combination Hot and Cold Mix Plants
- Portable Hot Mix Plants
- Stationary Combination Hot and Cold Mix Plants
- Cummer Combination Dryer-Coolers
- Steam Jacketed Mixers 400 to 8000 pounds capacity
- Cummer Internal Fire Dryers
- Electric Batch Timers
- Cummer Automatic Asphalt Meters

**— The F. D. —  
Cummer & Son Co.  
Euclid at 17th Cleveland, Ohio**



veyor division. Prior to his election as vice president he was works manager. He is a graduate of Sheffield Scientific School, Yale University, 1910. Mr. McKnight has been associated with the company since 1926 when he became secretary and sales manager of the Stearns Conveyor Co., a subsidiary of Chain Belt Co., located at Cleveland, O. In 1933 when the operations of the Cleveland plant were transferred to Milwaukee, Mr. McKnight was appointed sales manager of the company's conveyor division in which capacity he continues. He is a graduate of Purdue University, 1915.

## NEW LITERATURE

**Recording Truck Operating Cost**—A handy book for recording the costs of truck operation has been published by the Dodge division, Chrysler Corporation. The book, containing double-spread ruled pages for each month of the year, allows the truck operator to set down daily expenditures of gasoline, oil, repair and maintenance costs, as well as hours of operation, mileage, stops, etc. At the end of the month, the truck owner has a concise and easily analyzed record of his truck operating costs. Pages are also provided for a record of indirect costs such as taxes, license, garage, insurance, etc., and a summary of total expenses for the year. The book is distributed free of charge, and can be obtained by addressing a request to the Advertising Department of Dodge division, Chrysler Corporation, Detroit, Mich.

**Asphalt Plant**—The Iowa Manufacturing Co., Cedar Rapids, Ia., has just issued a loose leaf catalog covering the complete line of "Cedarapids" hot and cold mix asphalt plants and accessories. The book is made up of an introductory discussion of the future of bituminous construction and separate bulletins dealing with individual units and accessories. The catalog includes four types of asphalt plants: The Cedarapids hot or cold mix asphalt plant. The Cedarapids speedline portable asphalt plant. The Cedarapids traveling road-mix asphalt plant and the Cedarapids rapidmix asphalt plant. This new catalog illustrates several combinations of the batch type hot or cold mix plants, including both stationary and portable tower type equipment. In addition there are individual bulletins illustrating such separate units as driers, pug mills, hot and cold elevators, feeders, storage hoppers, screens, batchers, asphalt buckets, heater sets, scales and other accessories which can be assembled into complete plants to meet special conditions, or used to modernize existing plants. Complete specifications and dimension charts are given in each bulletin. Typical plant set-up drawings are shown for the larger plants.

**Street and Highway Lighting**—Under the title "Seeing and Traffic Safety" a new bulletin, summarizing a 5-year series of researches into the actual visual situation on streets and highways, has been issued by the General Electric Co., Nela Park, Cleveland, O. The bulletin is divided into two

parts: "Quick and Certain Seeing on Streets and Highways," and "Lighting for Seeing on Streets and Highways." The latter two sections, one dealing with automobile headlighting and the other with street and highway lighting.

**Excavator**—A catalog on its new and recently announced Type 30 line of excavators has been issued by The General Excavator Co., Marion, O. The catalog, No. 3902, gives the outstanding features of the Type 30 line, consisting of  $\frac{1}{2}$ ,  $\frac{3}{4}$ , and  $\frac{3}{4}$  cu. yd. machines as shovel, drag-line, crane, clamshell, pullshovel, skimmer, truck shovel, and crane, and with special wheel mount.

**Barricading of Excavations and Paving Job**—The Lumber Mutual Casualty Insurance Co. of New York has just gotten out a manual dealing with the correct barricading of road excavating and paving jobs. The book is profusely illustrated with photographs of actual road repair conditions, with right and wrong ways of barricading clearly ticketed, and short descriptions and explanations.

**Calcium Chloride in Ice Control**—A booklet containing the latest developments in the field of ice control with calcium chloride has been published by The Dow Chemical Co., Midland, Mich. Sections are devoted to the most recent advance in the methods utilized by highway departments to combat the most serious of winter driving hazards—The Value of Treating Abrasives—The Preparation of Stock Piles—The Skid Resistance of Dowflake—Treated Abrasives—Treatment of Abrasives at the Time of Application. Many helpful suggestions for the more efficient use of calcium chloride will be found in this new book. A copy can be obtained by addressing Dowflake Division, The Dow Chemical Co., Midland, Mich.

**Road Rollers**—A new illustrative catalog, No. H-4001, commemorating the 10th anniversary of Hercules rollers has been issued by The Hercules Co., Marion, O. The catalog describes and illustrates the details of Hercules Rollers, and the exclusive Hercules feature, the Ironeroll.

**Portable Crushers**—A new catalog featuring its Diamond portable crushers, manufactured in sizes ranging from 9 by 16 to 10 by 24 inches, has been issued by the Diamond Iron Works, Ind., and the Mohr Mfg. Co. Division, Minneapolis, Minn. The various crushers are illustrated and described and tables of capacities and specifications are given.

**Airport Drainage**—A 16 page bulletin dealing with the drainage of airports has been issued by the Clay Products Association, 111 W. Washington St., Chicago, Ill. Information is given on subsoil drainage and the installation of subdrains. Information likewise is given on surface drainage, together with designs for surface intercepting drains. Runoff diagrams for drainage computations are included.

**Carryall Scrapers, Bulldozers, Etc. Etc.**—A 32-page general catalog illustrating and describing its entire line of equipment and services has been issued by R. G. Le Tourneau, Inc., Peoria, Ill. The book has been written and prepared as though two men—an operator and an engineer or



You can turn many difficult drafting jobs into simple print room operations at a drastic saving with the Ozalid Whiteprint Process.

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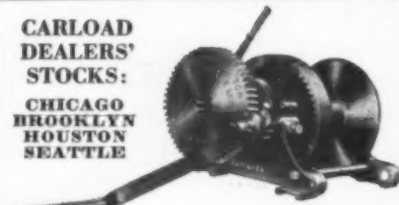
## Grace Two-Way Road Sweeper for Asphalt Construction



**W. E. GRACE  
MANUFACTURING COMPANY  
6000 Holmes Street  
DALLAS, TEXAS**

### CARLOAD DEALERS' STOCKS:

CHICAGO  
BROOKLYN  
HOUSTON  
SEATTLE



Capacity:	2-Ton	5-Ton	15-Ton
Net Wt.:	60 lb.	110 lb.	650 lb.
Price:	\$50.	\$75.	\$250.

Just use the right number divided about the load, blocked to suit, manned in unison, and

**SAVE AND BE SAFE WITH**

**ALL STEEL HAND HOIST**

SEATTLE, U.S.A.  
Beebe Bros., 2724 6th S., Seattle, Wash.

## Reliance— CRUSHING SCREENING and WASHING UNITS

● UP TO 2000 TONS A DAY ●

Crushers	Bin	Drag-Lines
Elevators	Pulverizers	"GAYCO"
Screens	Feeders	Centrifugal
Sweepers	Spreaders	Air Separators
Wash Boxes	Kettles	
	Conveyors	

**UNIVERSAL ROAD MACHINERY CO.**  
Kingston, N. Y.

Canadian Representatives: F. H. Hopkins & Co., Ltd.  
340 Canada Cement Co., Montreal, Que., Can.

## WALKER BAR No Drip!

★ FULL CIRCULATING  
SPRAY BAR for ALL ★  
BITUMINOUS DISTRIBUTORS

Easy to Install

WRITE FOR CIRCULARS

THE **EARL WALKER CO.** INC.  
SULLIVAN, ILLINOIS

contractor—were talking over and pointing out the features and advantages of the different tools to them. In addition to presenting the entire line, the operator, and contractor visit the Le Tourneau factory and see the construction and manufacture of the different machines; and also learn about the Tournacar welding service, and the Le Tourneau engineering and publication aids.

**Concrete Vibrators**—A 12-page publication has been issued by the Chicago Pneumatic Tool Co., 6 East 44th St., New York City, covering its complete line of concrete vibrators. General information on the vibrators is included and the various models are illustrated and described and specifications are given.

**Mixers, Draglines, Scraper, Dumptor**—Five new bulletins illustrating and describing five new models of construction equipment are available for general distribution by the Koehring Co., 3026 West Concordia Ave., Milwaukee, Wis. One of these relates to Koehring 10-S Dandie Mixer, which has many new design features, including a rubber-tired drum roller. Another bulletin concerns the new non-tilting 6-P Kwik-Mix plaster-mortar mixer. Two new model Koehring draglines are the subject of a bulletin. A new improved model Koehring wheeler having a capacity of 9½ cu. yds. is illustrated and described. Another bulletin concerns the new model W-60 dumptor.

**Diesel Tractor**—A 32-page 2-color catalog describing its new HD14 diesel tractor has been issued by Allis-Chalmers Manufacturing Co., Milwaukee, Wis. Features of this new tractor such as General Motors 2-cylinder engine, by-metallic steering clutches and brakes, and "positive seal" truck wheels, are described in detail and amply illustrated.

**Bituminous Mixers**—A 36-page booklet relating to its bituminous mixers has been issued by Barber-Greene Co., Aurora, Ill. This catalog 848 contains scores of actual operating photographs and much useful information on bituminous mixing. The first section is devoted to the basic unit or the mixer itself, which is described completely with a flow diagram explaining the Barber-Greene continuous proportioning and mixing. This is followed by the travel plant section showing the basic unit operating with the bucket loader. Many travel plant operating photographs are included together with complete information on travel plant operation. The subject of stabilization with the B-G travel plant is also well illustrated and described. The third section is devoted to central plant operation showing the basic unit with dryers and other accessories. This section not only includes many operating photographs, but also four typical central plant set-ups which are shown both photographically and diagrammatically, showing the plant being used with and without the new Barber-Greene gradation control unit. The remainder of the book covers the essentials of the gradation control unit, B-G dryers (both single and dual drum), and other Barber-Greene including the B-G tamping-leveling finisher and B-G bucket loaders.



## COMPOSITE CONSTRUCTION

more stiffness with less depth  
and at lower cost.

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